VOLUME II

TRANSCRIPT OF RECORD

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1952

No. 28

UNITED STATES OF AMERICA, ON THE RELATION OF OSCAR L. CHAPMAN SECRETARY OF THE INTERIOR, PETITIONER

vs.

FEDERAL POWER COMMISSION AND VIRGINIA ELECTRIC AND POWER COMPANY, ET AL.

No. 29

THE VIRGINIA REA ASSOCIATION, ET AL., PETITIONERS

vs.

THE FEDERAL POWER COMMISSION AND VIRGINIA ELECTRIC POWER COMPANY, ET AL.

ON WRITS OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FOURTH CIRCUIT

PETITION FOR CERTIORARI FILED MARCH 18, 1952
CERTIORARI GRANTED MAY 5, 1952

TESTIMONY OF MR. STANDBERG

CROSS-EXAMINATION

* * * * *

[266] Q. What storage capacity does the Roanoke Rapid site have in comparison with the Buggs Island Reservoir?

A. A negligible amount, so far as capacity of storage is concerned.

* * * * *

TESTIMONY OF MR. JESSEL

DIRECT EXAMINATION

* * * * *

[615] Q. You stated a moment ago that you made a study of probable markets for the Buggs Island project output. Will you state why you studied this project as the application before this hearing is only for the Roanoke Rapids project?

[616] A. The Roanoke Rapids project would be, in effect, a run-of-river development with only about 10,000 acre-feet of pondage. The flow of water to it would be controlled by the large reservoir of the upstream Buggs Island project. The releases of water to the Roanoke Rapids project would be determined by the operating procedure to be adopted for the Buggs Island project. In turn, the operating procedure for the Buggs Island project would be determined by the monthly load characteristics of the loads to be served by this project.

Thus, in order to estimate the monthly distribution of water flow for use through the Roanoke

Rapids project, I made a study to show how the output of the Buggs Island project might be marketed.

Q. What factors are considered by the engineering profession as controlling the availability and use of capacity and annual power output of undeveloped water power sites?

A. The controlling factors of power availability are water supply, reservoir storage, and available head, these being physical factors that determine the maximum usefulness of a particular site.

However large the stream flow may be, however much the reservoir storage may be developed, and whatever the head at the power plant, there are other factors that determine the maximum usefulness of water resources at a particular site. **[617]** These other factors relate to the method and manner of use of power output. Some water power plant sites are so remote as to be of practically no value at the present time although the stream flow may be enormous and the physical conditions might well justify a very high installation. We, therefore, must consider the market to be served by a proposed power plant and its relationship to other generating facilities in the area.

Exhibit 72

Estimated Generation and Discharge at Proposed Roanoke Rapids Project together with Existing Plant Assuming: (1) Operation of Buggs Island Plant as set forth in Exhibit 10; (2) Required Minimum Flow of 2000 cfs; (3) Rate of Increase in Flow Limited to 180 cfs per Minute; for:

WEEK OF PEAK LOAD - AUGUST 1953 - CRITICAL RIVER FLOW YEAR

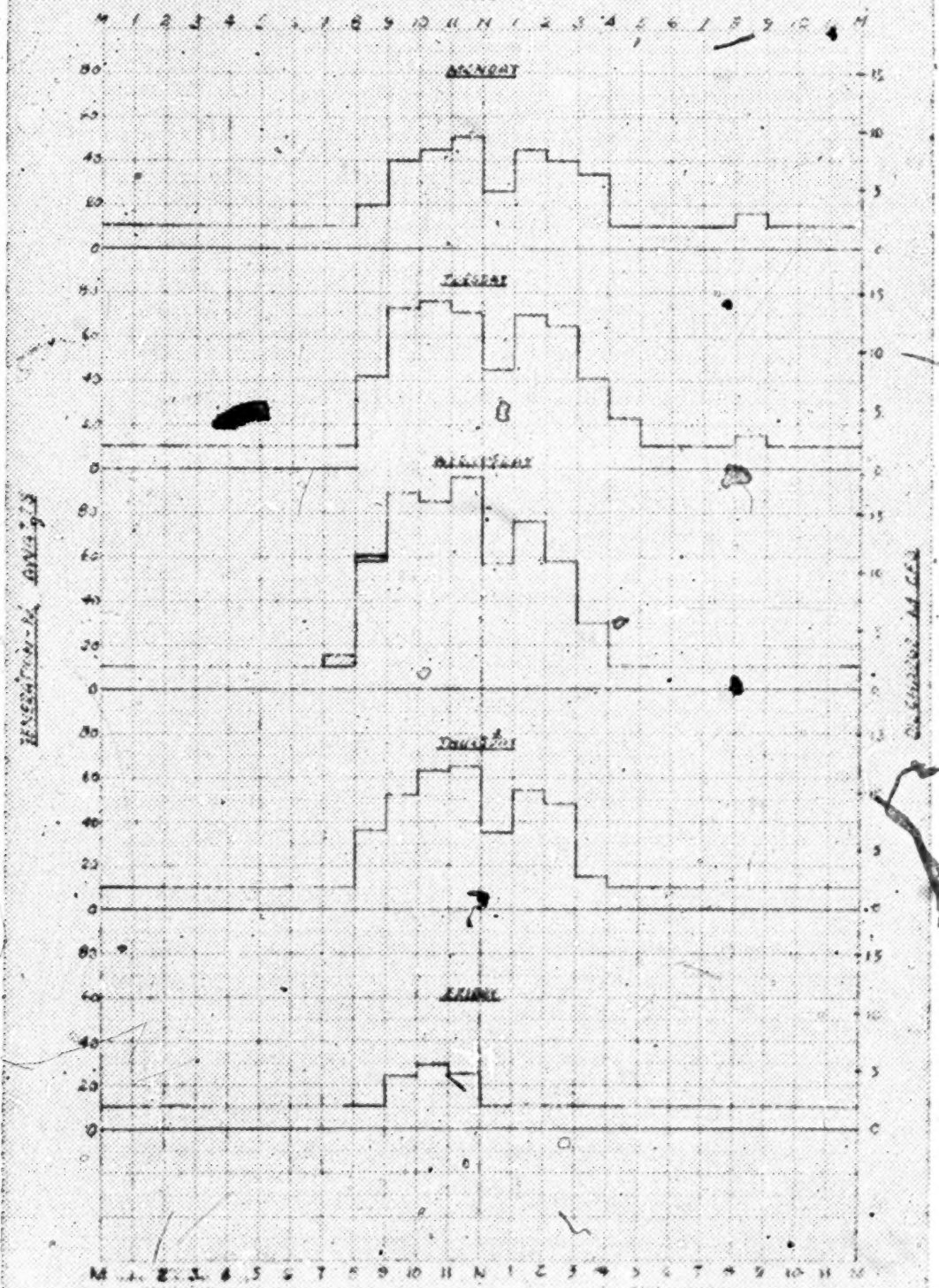
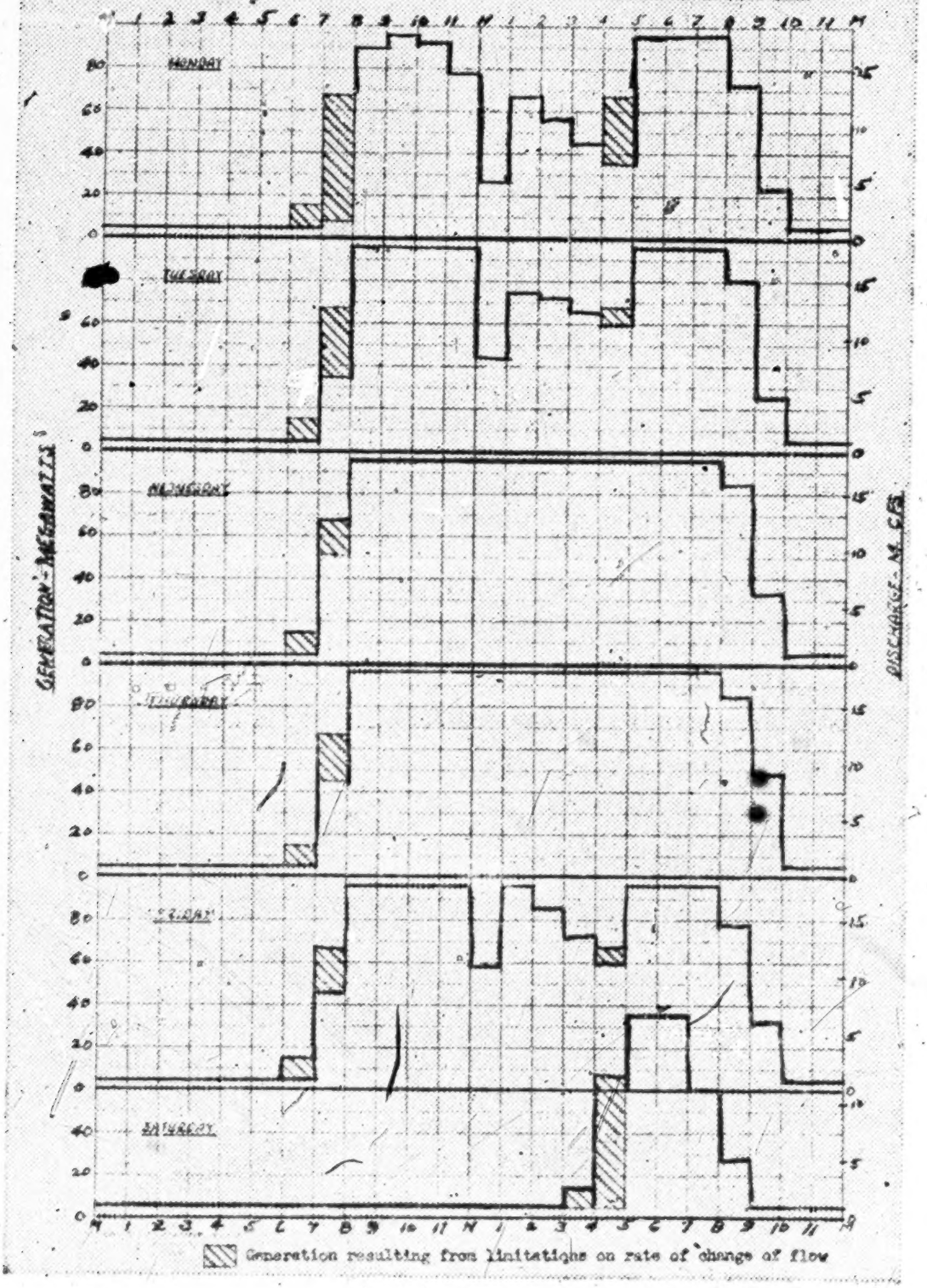


Exhibit 74

Estimated Generation and Discharge at Proposed Roanoke Rapids Project together with Existing Plant Assuming: (1) Operation of Buggs Island Plant as set forth in Exhibit 10; (2) Required Minimum Flow of 1000 cfs; (3) Rate of Increase in Flow Limited to 180 cfs per Minute; for:

WEEK OF PEAK LOAD - DECEMBER 1953 - AVERAGE AND CRITICAL RIVER FLOW YEAR



Exhibit

Estimated Generation and Discharge at Proposed Roanoke Rapids Project together with Existing Plant Assuming: (1) Operation of Buggs Island Plant as set forth in Exhibit 10; (2) Required Minimum Flow of 2000 cfs; (3) Rate of Increase in Flow Limited to 180 cfs per Minute and Flow not to be Doubled or Halved in Less Than One Hour; for:

TYPICAL WEEK - APRIL 1954 - CRITICAL RIVER FLOW YEAR

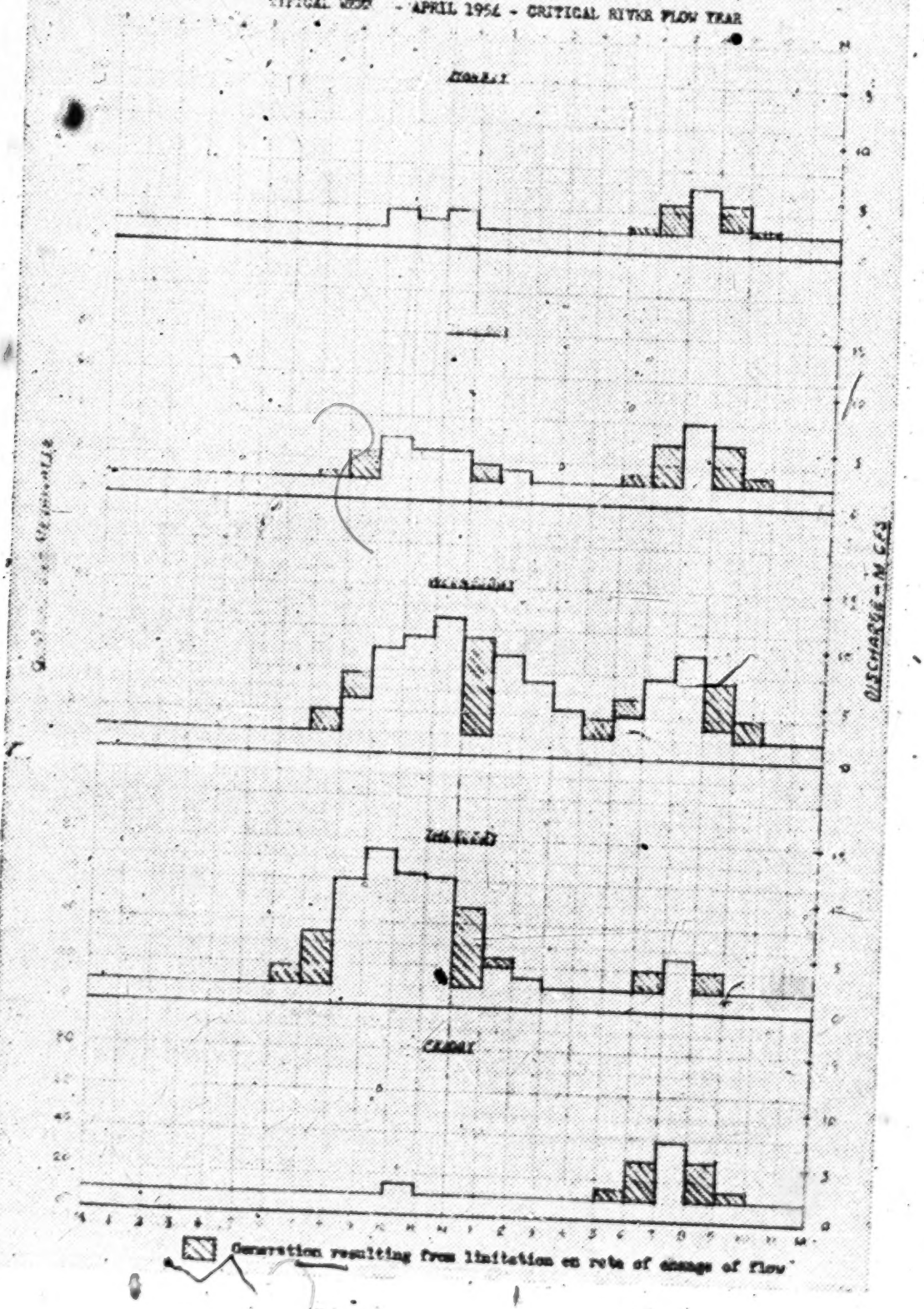


Exhibit 80

Average daily capacity furnished by Buggs Island during a critical December month (Dec. 2, 1917–Jan. 1, 1918)[1]

(a) Date and day	(b) Storage beginning day c. f. s.-days (See end of previous day)	(c) Average daily flow c. f. s.[2]	(d) Total available c. f. s. (b)+(c)	(e) Minimum flow—used in generating 2,650 kw.[3]	(f) C. f. s. used to generate in excess of 2,650 kw. (from (k), (d) or (c))	(g) Storage at the end of day c. f. s.-days from (d)−(e)−(f)	(h) Average kw. capacity 24 hrs. in excess of 2,650 (f)×5.3	(i) Average kw. capacity in excess of 2,650[4]	(j) Average kw. capacity including 2,650[4] (i)+2,650 kw.	(k) C. f. s. releases required for load pattern exhibit 74 in excess of 2,650 kw.	(l) Weighted average kw. capacity required to meet LP exhibit 74 in excess of 2,650 (k)×5.3	(m) Weighted average kw. capacity in excess of 2,650 required by exhibit 74[4]	(n) Weighted average kw. capacity required for LP exhibit 74 including 2,650[4] (m)+2,650	(o) Average capacity contributed by Buggs Island and existing plant[4] (n)−(j)	(p) Net average kw. contributed by Buggs Island less 5,000 kw. furnished by existing plant	(q) Load factor—pattern exhibit 74	(r) Derived peak without Buggs Island (j)+(q)	(s) Peaking capacity furnished from Buggs Island after deducting 5,000 kw. for existing plant 91,000−(r)
December																		
2 S	1,420	4,080	5,500	500		5,000			2,650				2,650					
3 M	5,000	3,740	8,740	500	8,240		43,672	65,508	68,158	8,245	43,785	65,547	68,197	39		0.710	96,000	
4 T		6,620	6,620	500	6,120		32,436	48,654	51,304	8,960	47,488	71,232	73,882	22,578	17,578	.770	66,600	24,400
5 W		5,870	5,870	500	5,370		28,461	42,691	45,341	10,380	55,014	82,521	85,171	39,830	34,830	.887	51,100	39,900
6 T		3,410	3,410	500	2,910		15,423	23,134	25,784	10,498	55,639	83,458	86,108	60,324	55,324	.897	28,700	62,300
7 F		3,090	3,090	500	2,590		13,727	20,590	23,240	9,280	49,184	73,776	76,426	53,006	48,006	.796	29,200	61,800
8 S		3,410	3,410	500	2,720	190	14,416	57,664	60,314	2,720	14,416	57,664	60,314			.628	96,000	
9 S	190	1,620	1,810	500		1,310			2,650				2,650					
10 M	1,310	1,620	2,930	500	2,430		12,900	19,300	21,950	8,245	43,785	65,547	68,197	46,247	41,247	.710	30,900	60,100
11 T		1,370	1,370	500	870		4,637	6,955	9,605	8,960	47,488	71,232	73,882	64,277	59,277	.770	12,500	78,500
12 W		1,250	1,250	500	750		3,975	5,962	8,612	10,380	55,014	82,521	85,171	76,559	71,559	.887	9,700	81,300
13 T		1,370	1,370	500	870		4,637	6,955	9,605	10,498	55,639	83,458	86,108	76,503	71,503	.897	10,700	80,300
14 F		900	900	500	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,320	83,700
15 S		900	900	500	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
16 S		900	900	500		400			2,650				2,650					
17 M	400	900	1,300	500	800		4,240	6,360	9,010	8,245	43,785	65,547	68,197	59,187	54,187	.710	12,700	78,300
18 T		900	900	500	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400
19 W		2,160	2,160	500	1,660		8,798	13,197	15,847	10,380	55,014	82,521	85,171	69,324	64,324	.887	17,900	73,100
20 F		3,090	3,090	500	2,590		13,727	20,590	23,240	10,498	55,639	83,458	86,108	62,868	57,868	.897	25,900	65,100
21 F		3,090	3,090	500	2,590		13,727	20,590	23,240	9,280	49,184	73,776	76,246	53,006	48,006	.796	29,200	61,800
22 S		3,090	3,090	500	2,590		13,727	54,908	57,558	2,720	14,416	57,664	60,314	2,756		.628	91,200	
23 S		1,620	1,620	500		1,120			2,650				2,650					
24 M	1,120	1,370	2,490	500	1,990		10,547	15,820	18,470	8,245	43,785	65,547	68,197	49,727	44,727	.710	26,000	65,000
25 T		1,370	1,370	500		870			2,650				2,650					
26 W	870	1,130	2,000	500	1,500		7,950	11,925	14,575	10,380	55,014	82,521	85,171	70,596	65,596	.887	16,400	74,600
27 T		1,130	1,130	500	630		3,330	4,995	7,645	10,498	55,639	83,458	86,108	78,463	73,463	.897	8,500	82,500
28 F		900	900	500	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,300	83,700
29 S		900	900	500	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
30 S		900	900	500		400			2,650				2,650					
31 M	400	900	1,300	500	800		4,240	6,360	9,010	8,245	43,785	65,547	68,197	59,187	54,187	.710	12,700	78,300
January																		
1 T		900	900	500	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400

[1] Assuming a pattern of operations like that shown on exhibit 74 with required minimum flow of 500 c. f. s.
[2] From U. S. G. S. water-supply papers.
[3] F. P. C. decision. (Examiner's decision p. 81.)
[4] Adjusted to 16 hours—weekdays, 6 hours—Saturdays.

Exhibit 81

(Revised) 6-12-50

Capacity of the proposed Roanoke Rapids project with and without Buggs Island during the critical month of December [1]

(a) Date and day	(b) Storage beginning day c. f. s.-days. (See end of previous day)	(c) Average daily flow c. f. s.[2]	(d) Total available c. f. s. (b)+(c)	(e) Minimum flow—used in generating 2,650 kw.[3]	(f) Flow available for capacity in excess of 2,650 kw. (d)−(e)	(g) Flow used for capacity in excess of 2,650 kw.[4]	(h) Storage at end of day c. f. s.-days (d)−(e)−(g)	(i) Average kw. capacity in excess of 2,650 kw. 24 hr. (g)×5.3	(j) Average kw. capacity in excess of 2,650[5]	(k) Average kw. capacity including 2,650 (j)+2,650	(l) Release required for LP exhibit 74 in excess of 2,650 kw.	(m) Average kw. capacity required to meet LP exhibit 74 in excess of 2,650 kw. 24 hr. (l)×5.3	(n) Average kw. capacity required in excess of 2,650 by LP exhibit 74[5]	(o) Average kw. capacity required for LP exhibit 74 including 2,650[5] (n)+2,650	(p) Average kw. capacity contributed by Buggs Island and existing plant[5] (o)−(k)	(q) Average kw. capacity contributed by Buggs Island less 5,000 kw. from existing plant[6] (p)−5,000	(r) Load factor pattern exhibit 74	(s) Related peak for Roanoke Rapids—kw.[7] (k)÷(r)	(t) Kw. peaking capacity furnished by Buggs Island after deducting 5,000 kw. for existing plant[8] 91,000−(s)
December																			
2 S	1,420	4,080	5,500	500	5,000		5,000			2,650				2,650					
3 M	5,000	3,740	8,740	500	8,240	3,240	5,000	17,200	25,700	28,350	8,245	43,698	65,547	68,197	39,847	34,847	0.710	39,900	51,100
4 T	5,000	6,620	11,620	500	11,120	6,120	5,000	32,436	48,654	51,304	8,960	47,488	71,232	73,882	22,578	17,578	.770	66,600	24,400
5 W	5,000	5,870	10,870	500	10,370	5,370	5,000	28,461	42,691	45,341	10,380	55,014	82,521	85,171	39,830	34,830	.887	51,100	39,900
6 T	5,000	3,410	8,410	500	7,910	2,910	5,000	15,423	23,134	25,784	10,498	55,639	83,458	86,108	60,324	55,324	.897	28,700	62,300
7 F	5,000	3,090	8,090	500	7,590	2,590	5,000	13,727	20,590	23,240	9,280	49,184	73,776	76,426	53,186	48,186	.796	29,200	61,800
8 S	5,000	3,410	8,410	500	7,910	2,910	5,000	15,423	61,700	64,350	2,720	14,416	57,664	60,314			.628	96,009	
9 S	5,000	1,620	6,620	500	6,120	1,120	5,000	5,940		8,590				2,650					

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Exhibit 81

Capacity of the proposed Roanoke Rapids project with and without Buggs Island during the critical month of December [1]

(Revised) 6-12-50

Date and day	(a)	(b) Storage beginning day c. f. s.-days. (Beg. end of previous day)	(c) Average daily flow c. f. s.[2]	(d) Total available c. f. s.-(b)+(c)	(e) Minimum flow—used in generating 2,650 kw.[3]	(f) Flow available for capacity in excess of 2,650 kw.-(d)−(e)	(g) Flow used for capacity in excess of 2,650 kw.[3]	(h) Storage at end of day c. f. s.-days (d)−(e)−(g)	(i) Average kw. capacity in excess of 2,650 kw. 24 hr. (g)×5.3	(j) Average kw. capacity in excess of 2,650[4]	(k) Average kw. capacity including 2,650[4] (j)+2,650	(l) Release required for LP exhibit 74 in excess of 2,650 kw.	(m) Average kw. capacity required to meet LP exhibit 74 in excess of 2,650 kw. 24 hr. (l)×5.3	(n) Average kw. capacity required in excess of 2,650 by LP exhibit 74[5]	(o) Average kw. capacity required for LP exhibit 74 including 2,650-(n)+2,650	(p) Average kw. capacity contributed by Buggs Island and existing plant[4] (o)−(k)	(q) Average kw. capacity contributed by Buggs Island less 5,000 kw. from existing plant[6] (p)−5,000	(r) Load factor pattern exhibit 74	(s) Related peak for Roanoke Rapids—kw.[5] (k)÷(r)	(t) Kw. peaking capacity furnished by Buggs Island after deducting 5,000 kw. for existing plant[6] 91,000−(s)
	10 M	5,000	1,620	6,620	500	6,120	2,016	4,104	10,685	16,028	18,678	8,245	43,698	65,547	68,197	49,520	44,520	.710	26,300	64,700
	11 T	4,104	1,370	4,474	500	3,974	2,191	1,783	11,612	17,418	20,068	8,960	47,488	71,232	73,882	53,814	48,814	.770	26,000	65,000
	12 W	1,783	1,250	3,033	500	2,533	2,533		13,425	20,138	22,788	10,380	55,014	82,521	85,171	62,383	57,283	.887	25,700	65,300
	13 T		1,870	1,370	500	870	870		4,611	6,917	9,567	10,498	55,639	83,458	86,108	76,541	71,541	.897	10,600	80,400
	14 F		900	900	500	400	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,300	83,700
	15 S		900	900	500	400	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
	16 S		900	900	500	400		400			2,650				2,650					
	17 M	400	900	1,300	500	800	800		4,240	6,370	9,020	8,245	43,698	65,547	68,197	59,177	54,177	.710	12,700	78,300
	18 T		900	900	500	400	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400
	19 W		2,160	2,160	500	1,660	1,660		8,800	13,200	15,850	10,380	55,014	82,521	85,171	69,321	64,321	.887	17,900	73,100
	20 T		3,090	3,090	500	2,590	2,567	23	13,605	20,408	23,058	10,498	55,639	83,458	86,108	63,050	58,050	.897	25,700	65,300
	21 F	23	3,090	3,113	500	2,613	2,269	344	12,025	18,038	20,688	9,280	49,184	73,776	76,246	55,558	50,558	.796	26,000	65,000
	22 S	344	3,090	3,434	500	2,934	665	2,269	3,524	14,096	16,746	2,720	14,416	57,664	60,314	43,568	38,568	.628	26,700	64,300
	23 S	2,269	1,620	3,889	500	3,389		3,389			2,650				2,650					
	24 M	3,389	1,370	4,759	500	4,259	2,016	2,243	10,685	16,028	18,678	8,245	43,698	65,547	68,197	49,519	44,519	.710	26,300	64,700
	25 T	2,243	1,370	3,613	500	3,113		3,113			2,650				2,650					
	26 W	3,113	1,130	4,243	500	3,743	2,538	1,205	13,451	20,176	22,826	10,380	55,014	82,521	85,171	62,345	57,345	.887	25,700	65,300
	27 T	1,205	1,130	2,335	500	1,835	1,835		9,725	14,588	17,238	10,498	55,639	83,458	86,108	68,870	63,870	.897	19,200	71,800
	28 F		900	900	500	400	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,300	83,700
	29 S		900	900	500	400	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,800	73,200
	30 S		900	900	500	400		400			2,650				2,650					
	31 M	400	900	1,300	500	800	800		4,240	6,370	9,020	8,245	43,698	65,547	68,197	59,177	54,177	.710	12,700	78,300
	January																			
	1 T		900	900	500	400	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400

[1] Assuming a pattern of operations parallel to Exhibit 74 with a minimum flow of 500 c. f. s.

[2] Flow pattern adjusted where possible to .244×flow in Exhibit 74. 0.244=relation of total daily flows for month to totals required by LP Exhibit 74, both decreased by required minimum flow.

[3] In excess of load pattern because of full storage.

[4] Flow available did not meet load pattern.

[5] Adjusted to: 16 hr.-weekdays. 6 hr.-Saturdays

[6] Examiner's Decision p. 81.

[7] U. S. G. S. Water Supply Papers

TESTIMONY OF MR. HAMILTON

DIRECT EXAMINATION

[2866] Q. How large is the reservoir at Buggs Island, according to the Definite Project Report?

A. 1,085,000 acre-feet reserved for power, equivalent to 542,500 c. f. s. days;

1,345,000 acre-feet reserved for flood control, equivalent to 672,500 c. f. s. days;

A total of 2,430,000 acre-feet controlled storage, equivalent to 1,715,000 c. f. s. days.

Q. Is it conceivable that the reservoir at Buggs Island, with 1,085,000 acre-feet for power, and 1,345,000 acre-feet for flood control, would not contribute any capacity to Roanoke Rapids?

A. No, that it is not conceivable.

Q. Why?

A. This large reservoir for holding back water up to an amount of 1,085,000 acre-feet, or 542,000 c. f. s. days, for power, increases the average flow in low-water periods from 2,660 c. f. s. to 4,310 c. f. s. It is bound to increase the capacity of the Roanoke Rapids project.

[2867] It must also be noted that, in order to increase the capacity of the proposed project from approximately 98,000 horsepower to 125,000 horsepower, the applicant amended its application to include the excavation of an expensive tailrace. This tailrace will fill up when the project operates at its full capacity, requiring a release of 18,050 c. f. s. In periods of flood water flow, the tailrace and the river

channel will fill up, reducing the head of the project and its capacity.

With the employment of 1,345,000 acre-feet or 672,500 c. f. s. days of storage to lower the crest of floods in the river from 270,000 c. f. s. to 60,000 c. f. s., the effect of the flood waters on the tailrace and the river channel below the project will be considerably diminished. Therefore, in this manner, also, the capacity of the project will be increased.

Q. Have you made a study of the extent to which Buggs Island will increase the capacity of Roanoke Rapids?

A. Yes.

Q. What is the nature of the study?

A. The best way to determine the extent to which the capacity of Roanoke Rapids will be increased by Buggs Island is to visualize the operations of Roanoke Rapids without Buggs Island, as compared with the operations of the same project under the same conditions with Buggs Island.

Q. For the operation of Roanoke Rapids with Buggs [2868] Island, what did you take as your basis of comparison?

A. I took the load pattern in Exhibit 74, with the assumption that the minimum releases required would be 500 c. f. s., only, rather than 1,000 c. f. s.

Q. For the operation of Roanoke Rapids without Buggs Island, what did you take as your basis of comparison?

A. I took the average daily flows in the month of December 1917, which was a low flow or critical

month. I assumed, first, that the project will start operation on the first Monday in the month with a full reservoir; second, that the minimum releases required will be 500 c. f. s.; and, third, that Roanoke Rapids would be operated on a pattern parallel to the one in Exhibit 74.

Q. Why did you not assume that Buggs Island would not add any capacity to Roanoke Rapids, and that you could operate Roanoke Rapids without Buggs Island, with exactly the same pattern as shown in Exhibit 74?

A. If you assume that Buggs Island will contribute no capacity to Roanoke Rapids, then it must follow that the project would be operated with the pattern in Exhibit 74, either with or without Buggs Island. But if you begin operating Roanoke Rapids without Buggs Island, in accordance with the pattern in Exhibit 74, you run out of storage on the first day of operation. At no time in the month can you store any water, except a small amount on Sundays, and at no time do you [2869] obtain the capacity required in Exhibit 74.

Q. Have you caused to be prepared an exhibit illustrating this fact?

A. Yes, it is Exhibit No. 80. You will see from column (f) that we use all the water we can up to the amount required by Exhibit 74, and we operate with an empty reservoir, except for the small amounts accumulated over week-ends. You can also see by the last column that the difference in capacity is very great.

Q. Can you then assume that Buggs Island contributes no capacity to Roanoke Rapids?

A. No. On the contrary, what I have just said is proof positive that Buggs Island contributes a large part of the capacity of Roanoke Rapids, when the latter project is operated in accordance with Exhibit 74.

Q. Have you caused to be prepared an exhibit comparing the operations of Roanoke Rapids with and without Buggs Island, on the basis and with the assumption you have stated?

A. I have.

Q. Is it the exhibit entitled "Capacity of the Proposed Roanoke Rapids Project with and without Buggs Island," marked for identification as Exhibit 81?

A. It is.

Q. Will you please explain this exhibit?

A. The method employed in this exhibit is similar to [2870] the one in Exhibit 79, which I have already explained. Therefore, I shall merely point out the important differences.

First, in column (e), we have the actual water flows for the month of December 1917.

Second, the exhibit is carried out for the entire month, rather than for a single week, because the daily flows are not constant.

Third, not all of the flow available for capacity, as shown in column (f), is used for capacity. As shown in column (g), only so much of the flow is used as would be necessary to follow a pattern parallel to Ex-

hibit 74. Thereby, we are assured of storage and are able to obtain the maximum capacity for the entire month.

Fourth, in the latter part of the month, where the flows are as low as 900 c. f. s. on a large number of days, the water used is varied so as to obtain the maximum capacity for the period. If we had followed the same releases of water in the latter part of the month as we did in the first part of the month, we would soon have run out of water and would have had very little capacity.

Q. What results have you arrived at?

A. As shown in this exhibit, both the average and the dependable capacity of the Roanoke Rapids project with Buggs Island in operation are considerably greater than without Buggs Island in operation.

[2871] Q. Does that mean that the difference is contributed by Buggs Island?

A. Yes.

Q. How much is contributed in dependable capacity?

A. I should say around 75,000 kilowatts.

Q. Is this the greatest difference for the month?

A. No. Strictly speaking, I should take the greatest difference, which would be 83,700 kilowatts. But to resolve further differences in favor of the applicant's proposed project, I tested the figures by what one might call an average critical month of December. I found that the greatest difference in such a month is not less than 76,000 kilowatts.

Q. Does Buggs Island contribute anything to Roanoke Rapids by way of energy output?

A. We can take the applicant's own figures. If you will look at Exhibit 15, you will find that the estimated annual output is 345,000,000 kilowatt hours with Buggs Island in operation. Exhibit 28 shows that, without Buggs Island, the estimated annual output of energy is 275,000,000 kilowatt hours. The difference, 70,000,000 kilowatt hours, is contributed by Buggs Island.

Q. Can you now state what would be the contribution of Buggs Island in terms of money?

A. Valuing dependable capacity, 75,000 kilowatts, at $22.54 per kilowatt, and valuing the energy, 70,000,000 [2872] kilowatt hours, at 3.79 mills per kilowatt hour, the extent of the contribution of Buggs Island to Roanoke Rapids is $1,955,000 per year.

Q. And is this the annual amount by which Roanoke Rapids will benefit from Buggs Island?

A. It is.

Exhibit 15

Virginia Electric & Power Co.—Evaluation of Roanoke Rapids hydro-electric project—Project No. 2009 amended—91,000 kilowatts with tailrace canal

		Roanoke Rapids hydro program	Equivalent steam program
Capability, kw.:			
New		91,000	91,000
Existing		5,000	5,000
Total		96,000	96,000
Average annual output:			
On-peak kw.-hr.:			
New	millions	309	315
Existing	do	24	18
Total	do	333	338
Off-peak kw.-hr.:			
New	do	36	27
Existing	do	6	15
Total	do	42	42
Estimated investment:			
Power development		$25,085,000	$11,757,000
Substation step-up and step-down		1,113,000	1,324,000
Transmission lines		540,000	500,000
Total		26,738,000	13,581,000
Assuming financing:			
55 percent debt		14,706,000	7,470,000
45 percent equity		12,032,000	6,111,000
Permissible net return on investment, 6 percent		1,804,000	815,000
Interest on debt, 3 percent		441,000	224,000
Balance for surplus		1,163,000	591,000
Balance before Federal income tax		1,876,000	953,000
Federal income tax, 38 percent		713,000	362,000
Permissible net return plus Federal income tax		2,317,000	1,177,000
Depreciation:			
Hydro, 58-year sinking fund at 6 percent	0.212 percent	53,000	
Steam, 35-year sinking fund at 6 percent	.897 percent		105,000
Substation, 30-year sinking fund at 6 percent	1.26 percent	14,000	17,000
Transmission line, 30/50-year sinking fund 6 percent		2,000	4,000
Property tax		304,000	99,000
Annual capital charges and taxes		2,690,000	1,402,000
Transmission line and substation operating and maintenance expenses		7,000	21,000
Fixed station operating and maintenance less fuel, $2.35/kw. for steam		107,000	214,000
Variable station operating and maintenance less fuel, $0.000148/kw.-hr			51,000
Total operating and maintenance less fuel, station, substation, and lines		114,000	286,000
General and administrative expenses and payroll taxes, Virginia, 12.7 percent; North Carolina, 13.3 percent.		15,000	36,000
General and administrative expenses for hydro license		10,000	
Fuel expense ($5.50 per ton f. o. b. mines)			1,509,000
Total annual cost		2,829,000	3,233,000
Excess of annual cost of steam over hydro		404,000	

Exhibit 28

Virginia Electric & Power Co.—Evaluation of Roanoke Rapids Hydro-electric project—Project No. 2009 amended—91,000 kilowatts with tailrace canal assuming natural river flow conditions in the absence of Buggs Island Reservoir

		Roanoke Rapids hydro program	Equivalent steam program
Capability, kw:			
New		91,000	93,000
Existing		5,000	3,000
Total		96,000	96,000
Average annual output:			
On peak kw. hr.:			
New	millions	215	220
Existing	do	24	19
Total	do	239	239
Off peak kw. hr.:			
New	do	60	51
Existing	do	8	17
Total	do	68	68
Estimated investment:			
Power development		$25,085,000	$12,016,000
Substation step-up and step-down		1,244,000	1,273,000
Transmission line		461,000	461,000
Total		26,790,000	13,750,000
Assumed financing:			
55 percent debt		14,735,000	7,563,000
45 percent equity		12,055,000	6,187,000
Permissible net return on investment, 6 percent		1,607,000	825,000
Interest on debt, 3 percent		442,000	227,000
Balance for surplus		1,165,000	598,000
Balance before Federal income tax		1,879,000	965,000
Federal income tax 38 percent		714,000	367,000
Permissible net return plus Federal income tax		2,321,000	1,192,000
Depreciation:			
Hydro, 58-year sinking fund at 6 percent	0.212 percent	53,000	
Steam, 35-year sinking fund at 6 percent	0.897 percent		108,000
Substation, 30-year sinking fund at 6 percent	1.26 percent	16,000	16,000
Transmission line 30/50-year sinking fund at 6 percent		4,000	4,000
Property tax		302,000	57,000
Annual charge and taxes		2,696,000	1,377,000
Transmission line and substation operation and maintenance expenses		9,000	9,000
Fixed station operation and maintenance less fuel $2.35/kw		107,000	212,000
Variable station operation and maintenance less fuel $0.000148/kw.-hr			40,000
Total operation and maintenance less fuel station substation and lines		116,000	268,000
General and, and administrative expense and payroll taxes, Virginia, 12.7 percent; North Carolina; 13.3 percent		15,000	36,000
General and administrative expenses for hydro license		10,000	
Fuel expense ($5.50/ton f. o. b. mines)			1,299,000
Total annual cost		2,837,000	2,980,000
Excess of annual cost of steam over hydro		143,000	

Cross-examinations by Mr. WHITEHEAD:

[394] Q. Turning now, Mr. Cary, to Exhibit number 15, which I believe you produced——

A. That is correct.

Q. You are, of course, thoroughly familiar with this statement?

A. It was prepared under my direct supervision.

Q. In this statement prepared under your direction was there any charge made or entered on account of any benefits which your company would receive as a result of the headwater improvement by the government at Buggs Island?

A. No.

Q. Why was not some figure put in for that item?

A. I have no idea how the requirement or how the amount of such a payment would be calculated.

Q. Did your company endeavor to calculate it?

A. No; we did not try to calculate the charge because we didn't know the basis for it. In our discussions with the engineering staff of the Commission we investigated that and found that the Commission had never set up any standard procedure for making that determination.

Q. Notwithstanding that this requirement has been in the Federal Power Act for many years, nothing has been set up within the Commission to take care of the government and other owners of upstream improvements?

A. That was the impression I was left under.

Q. Do you recognize, Mr. Cary, that by reason of this [395] upstream improvement at Buggs Island your company, if it is granted the license for which it applies at Roanoke Rapids, will derive considerable benefits?

A. We will derive benefits.

Q. Have you any way of approximating them?

A. Yes. I think the benefits can be approximated.

Q. How far has your company gone in approximating those benefits?

A. I have made some preliminary investigation to determine, more or less, the maximum amount that those benefits could be, but I have no idea or no way of knowing, rather, that the Federal Power Commission would determine the benefits in the same way that I determined them.

Q. Now, irrespective of what the Federal Power Commission may or may not ultimately do, what was the figure that you arrived at?

A. My calculations indicated that the maximum possible benefit from the Buggs Island development would be $261,000 annually.

* * * * *

[460] By Mr. HANKIN:

Q. Mr. Cary, will you turn in your Exhibit 15 on which you show that the annual cost of the proposed Roanoke Rapids project would be less by $404,000 than an equivalent steam plant. You stated you did not take into consideration the downstream benefits

which this project would derive from the upstream projects; is that correct?

A. I don't think that is quite correct.

Q. Meaning that in the computation of your $404,000 you did take into consideration the benefits?

A. I stated that this computation was based on the assumption that Buggs Island was in operation.

* * * * *

[461] Q. Now, Mr. Witness, as I understand, whatever downstream benefits you will derive are not reflected in Exhibit 15; is that correct?

A. They are reflected in Exhibit 15.

Q. In what figure are they reflected?

A. In the energy figures up near the top of the tabulation. I would like to add to that, that by the same token they are reflected down below in the fuel expense item.

Q. All that I am asking you is this: Assuming that in order to operate this project you will be required to pay downstream benefits, would that, or would that not raise the annual cost of Roanoke Rapids hydro project?

A. I am sorry, I missed the latter part of that question.

Q. Assuming that you are required to pay downstream benefits which you derive from the upstream projects, is that amount [462] reflected in your total annual cost relating to your Roanoke Rapids hydro program?

A. It is not.

* * * * *

[463] On page 394 of the transcript, Mr. Whitehead asked you:

[464] Why was not some figure put in for that item?

Meaning downstream benefits, and then you stated:

> I have no idea how the requirement or how the amount of such payment would be calculated.

Then on page 395, you calculated the maximum amount to be $261,000 per year.

First of all, I would like to ask you, assuming that this figure of $261,000 were added to the annual costs of the Roanoke Rapids project, what would be the effect on the feasibility of your project?

A. It would reduce the economic advantage of the hydro project as compared to a steam project.

Q. And the excess of annual cost of steam over hydro would be how much?

A. $143,000.

Q. How did you arrive at this figure of $261,000?

A. By substracting from the $404,000, which is the figure developed on Exhibit 15 as the excess of the annual cost of an equivalent steam program over the hydro program involving this particular project; then I made a similar calculation to determine what the same excess of annual cost would be for a complete program, using the Roanoke Rapids project on the assumption that the Buggs Island development was not in existence, and comparing that with an equivalent steam program.

By exactly the same method of computation I arrived at a [465] figure of $143,000. The $261,000 is simply the difference between those two figures, and as I stated yesterday, it represents the maximum possible benefits to the Virginia Electric and Power Company—if it goes ahead with this project—as a result of the Buggs Island development. But it does not indicate in any way the payments that will have to be made. And I would like to distinguish between the determination of benefits and the determination of payments.

* * * * *

Q. You say that you arrived at the $261,000 by determining the excess of annual cost of steam over hydro of Roanoke Rapids without the existence of Buggs Island?

A. That is correct.

Q. How did you arrive at that figure?

A. I think I just answered that question. By making a similar computation as that shown on Exhibit 15——

Q. Do you have that computation available?

[466] A. Yes, I do.

Q. Right here?

A. Yes.

Q. You mean to say you have a computation of Roanoke Rapids without Buggs Island operation?

A. Yes.

Q. Can you make it available to us so that we might be able to examine it?

A. It can be made available.

Q. Will you do it?

* * * * *

Mr. MOORE. We ask that it be received as Exhibit No. 28.

CHIEF PRESIDING EXAMINER. It will be identified as Exhibit No. 28.

(The document referred to above was identified as Exhibit No. 28.)

CHIEF PRESIDING EXAMINER. Are you offering it in evidence?

Mr. MOORE. Yes, sir.

CHIEF PRESIDING EXAMINER. Without objection, it will be received.

* * * * *

TESTIMONY OF MR. UHL

DIRECT EXAMINATION

* * * * *

[120] Q. In your judgment, is the plan of development as now proposed in the application, as amended, in this proceeding the one best adapted to a comprehensive plan for improving or developing the Roanoke River throughout the reach of the river from Buggs Island to Weldon, North Carolina, for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water power development, and for other beneficial public uses, including recreational purposes, as more particularly set forth in House Document No. 650, and in answering this question, will you give your reasons for your conclusion.

A. Yes; in my judgment it is. My reason for this is that it utilizes to the maximum feasible extent the full river flow and the full fall of the river through-

out the reach of river involved and at the same time does not adversely affect the feasible development of the river either above or below it. It is also capable of making full practical use of the proposed upstream river improvements when and if they are constructed.

MR. SUNDA

DIRECT EXAMINATION

* * * * *

[583] Q. Has the Commission staff made a study to determine the dependable capacity during the critical period and the average annual output of Project No. 2009?

A. Yes, it has.

Q. What is the critical low water period used in determining the dependable capacity?

A. The critical period extends from April 25, 1930, to March 22, 1931, as determined in Exhibit 10, Definite Project Report on Buggs Island Reservoir.

Q. What do staff studies show as to the amount of dependable capacity available during the critical period?

A. Using the critical period extending from April 25, [584] 1930, to March 22, 1931, during which time flows would be those released by the Buggs Island project for power and other purposes, the Commission staff has determined that the dependable capacity of project No. 2009 would be about 91,000 kilowatts.

Q. Will you explain what you mean by the term "dependable capacity"?

A. Dependable capacity is that generating capacity that can be relied upon for serving the system load under adverse water conditions, limited by the characteristics of the load to be served. The characteristics of the load will be covered in the testimony of Dr. J. J. A. Jessell, of the Commission staff.

Q. What is the staff's estimate as to the average annual energy output from Project No. 2009?

A. Based on reservoir operation of Buggs Island project for the period 1912 to 1945, inclusive, as shown on plates 27 and 55, in Exhibit 10, Definite Project Report on Buggs Island Reservoir, estimated average annual energy output from Project No. 2009 would be about 308 million kilowatt hours.

Q. Using the same basis, what is the staff's estimate as to the average annual energy output from Project No. 2009 and the applicant's existing hydro project at Roanoke Rapids?

[585] A. The estimated average annual output from the proposed and existing project would be about 333 million kilowatt hours.

Q. What is the staff's estimate of the average annual value of capacity and energy of project No. 2009?

A. The estimated average annual value of the capacity and energy would be about $3,218,000 based upon a value of $22.54 per kilowatt of capacity and 3.79 mills per kilowatt hour for energy.

Q. Why do you use the capacity value at $22.54 per kilowatt of capacity and the energy value at 3.79 mills per kilowatt hour?

A. These figures represent the cost of supplying the equivalent amount of capacity and energy from an alternate new steam electric plant. The capacity charge of $22.54 represents the annual fixed charges and operating costs and the energy figure of 3.79 mills represents the variable operating and maintenance costs and fuel charges.

Q. Mr. Sunda, has the Commission staff reviewed the cost estimate submitted in the application for license as amended for Project No. 2009?

A. The estimate of cost as shown in Amended Exhibit filed with the amendment of application has been reviewed and has been found to be reasonable with the exception that the estimate did not include certain overhead costs.

[586] Q. What are the items of overhead cost to be added to the estimate?

A. The items are legal expense, taxes during construction, administrative and miscellaneous general expense, and interest during construction.

Q. After adding these items in the applicant's estimate of cost, what do you estimate the cost of the project to be?

A. The estimate of cost is $27,233,000.

Q. Does this estimate of cost agree substantially with that estimated by the Army Engineers for a similar project in its report on the application for license for Project No. 2009 which is marked for identification as Exhibit 11?

A. Yes, it does. The Army Engineers estimate of cost is $27,144,000 for a similar project.

Q. What is the staff's estimate of the average annual cost of the proposed Roanoke Rapids project?

A. The estimated annual cost including both fixed charges and operating costs is $2,892,000.

Q. Would the average annual value of the capacity and energy exceed the annual cost?

A. I have already testified that the average annual value would be approximately $3,218,000 which would exceed the average annual cost by about $326,000.

* * * * *

[588] Q. What are your conclusions as to the proposal of the applicant, Virginia Electric and Power Company, to construct Project No. 2009, so far as concerns its economic feasibility and its adaptability to the most comprehensive plan for developing the water resources of the region for improving the Roanoke River for the use or benefit of interstate commerce, for the improvement and utilization of water power development and for other beneficial public uses, including recreational purposes?

A. In my opinion, this proposed Project No. 2009 is economically feasible and would be best adapted to a comprehensive plan for the purposes which you mention.

CROSS EXAMINATION

[731] Q. You have stated that with Buggs Island in operation, the average annual energy output of the proposed and the existing projects would be 333,000 kw. What would be the estimated——

Mr. MOORE. 333 million.

By Mr. HANKIN:

Q. 333 million kilowatt hours. What would be the estimated average annual energy output without Buggs Island in existence?

A. We made no such computations since Buggs Island is under construction and will be in operation at the time the project goes into effect.

Q. With a margin of cost of hydro as compared with steam, and you testified it to be $326,000, would you say that that is a wide margin or a narrow margin?

A. It is a reasonable margin.

Q. Well, with that margin, would you say that it is necessary to determine the amount of downstream benefits in order to establish the feasibility of the project?

A. Until such time as the Roanoke Rapids——

* * * * *

[732] The WITNESS. * * * There is no method of computing downstream benefits at the present time, until the project is actually under operation.

By Mr. HANKIN:

Q. Now, do you mean that your engineering knowledge does not extend to the point of estimating the amount of downstream benefits at this present time?

A. That is correct.

Q. Then you do not agree with the witnesses who have testified before that they could compute the probable amount of downstream benefits to be assessed?

* * * * *

[733] The WITNESS. I know what Mr. Cary testified to the other day, and on that basis I can make some answer.

* * * * *

[734] The WITNESS. We made no computation of that since we have no basis on which to determine it at the present time.

By Mr. HANKIN:

Q. You say you have no basis for determining it at all?

A. That is correct.

Q. The Commission has no formula which has been used, or which might be used, under similar circumstances?

A. That is correct.

Q. So that with a margin of $326,000, as you testified, as the comparison between hydro and steam, you say that it is not necessary to give any consideration to the downstream benefits to see whether the project is feasible or not?

A. Consideration was given, but no computation was made [735] since we have no basis to make the computation until such time as the Roanoke Rapids Project actually derives benefits from the Buggs Island Project.

Q. Do I understand, then, that the license might be granted even if the downstream benefits would exceed $326,000?

A. There is no such method of making such a computation at the present time.

* * * * *

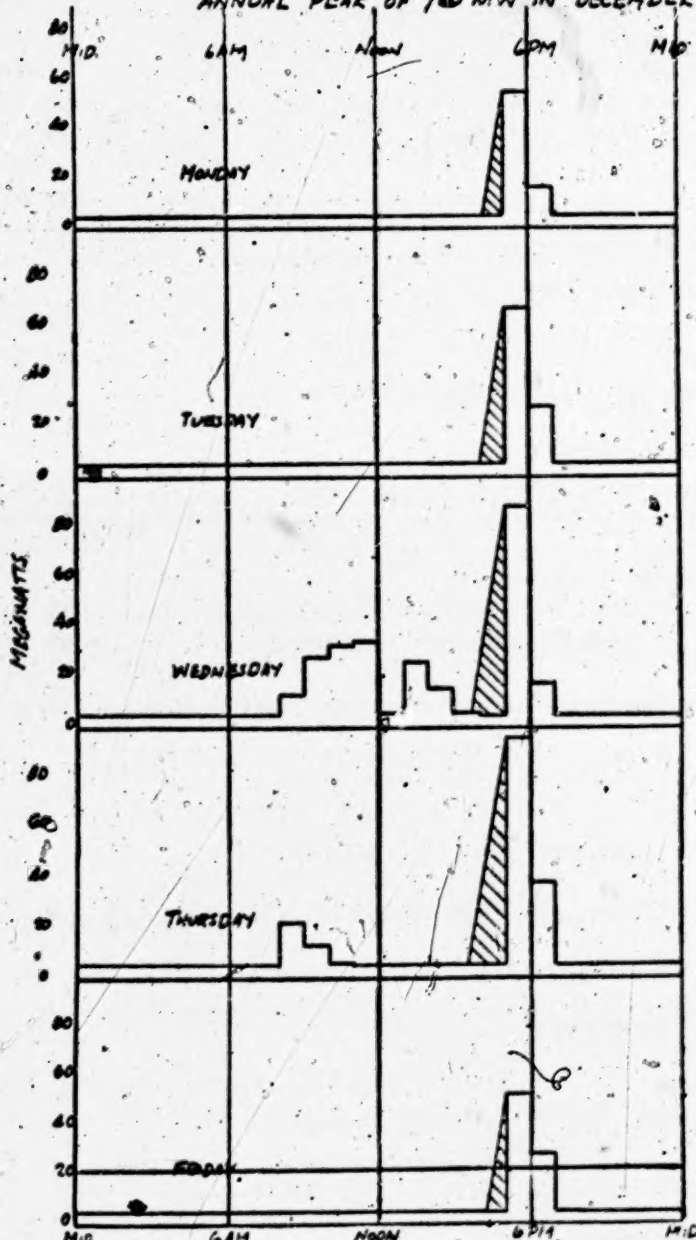
Q. Is it contemplated that the recommendations will be made to the Commission without consideration of the downstream benefits?

A. The fact is that downstream benefits will be pointed [736] out to the Commission. Other than that there will be no computation made of the benefits to be derived.

* * * * *

Exhibit 61.

OPERATION OF PROJ. NO. 2009 AND EXISTING PLANTS AT ROANOKE RAPIDS
CARRYING LOAD ABOVE 624 MW IN WEEK OF
ANNUAL PEAK OF 780 MW IN DECEMBER 1953



Interior—Duplicating Section, Washington, D. C.

Exhibit 16

Virginia Electric & Power Co., estimated capability available 1953

	Kilowatts
May 1949:	
Dependable steam	499,000
Dependable hydro	10,000
October 1949: Chesterfield unit No. 2	74,000
July 1950: Bremo unit No. 3	71,000
May 1951: Reeves Ave. unit No. 7	24,000
August 1951: Possum Point unit No. 2	74,000
Total	752,000
Contemplated retirements	38,000
1953 Dependable capability:	
Authorized	714,000
Buggs Island	89,000
1953 Increase at existing Roanoke Rapids station	2,000
1953 Dependable capability:	
VEPCO and Buggs Island	805,000
Roanoke Rapids project	91,000
1953 Total dependable capability:	
VEPCO with Buggs Island and Roanoke Rapids	896,000
If one-half of Buggs Island is sold to others	45,000
VEPCO with one-half Buggs Island and Roanoke Rapids	851,000

Testimony of Mr. Cary

Direct Examination

[149] (The document referred to was received in evidence as exhibit number 16.)

By Mr. Moore:

Q. Will you now comment on the facts shown on this table, Mr. Cary?

A. This table shows the dependable capability of the various components entering into the total capability for carrying the system peak load in 1953. I wish to point out that the peak load on the system of the Virginia Electric and Power Company is a

relatively sharp peak of only about one hour's duration which occurs in the evening usually from about 5 to 6 p. m. during the month of December. This is the critical peak which determines the amount of facilities required on the system. The loads which occur in the mornings and have a duration of several hours are of substantially less magnitude and are not critical in that they do not control the amount of generating facilities required by the system.

The first two items of the tabulation in the Exhibit show the dependable capability of the existing steam stations and the hydro stations as now exist. The next four items show the anticipated increases in capacity from the various steam station additions already authorized. This results **[150]** in a total capability of 752,000 kw. before contemplated retirements are made. After the contemplated retirements amounting to 38,000 kw. the dependable capability of our existing stations and authorized additions will be 714,000 kw. The next item shows the dependable capability of the Buggs Island project. The next item shows the increase in capability of our existing Roanoke Rapids hydro station resulting from improved river flow conditions. The next item shows the dependable capability of the then existing Virginia Electric and Power Company system plus the capability of the Buggs Island development, 805,000 kw. The next item shows the dependable capability of the Roanoke Rapids project, 91,000 kw., which results in a total dependable capability of 896,000 kw., with both Roanoke Rapids and the Buggs Island develop-

ments. The next item shows ½ of the dependable capability of the Buggs Island development, and the last item shows the dependable capability of the system with the Roanoke Rapids development and ½ of the capability of the Buggs Island development, which is 851,000 kw.

Q. In your judgment, is the proposed Roanoke Rapids project involved in this proceeding economically feasible for the Applicant, even if the Applicant purchases the entire output, or a substantial part of the output, of the Buggs Island project, and, if so, will you kindly state your reasons for your conclusions?

[151] A. Yes, it is, because the loads expected in 1953 and 1954 will require power capacity of such magnitude that the Company will need, in addition to its presently authorized additions to its steam stations and the capacity of the Roanoke Rapids project, substantial additional capacity which will have to be supplied either by the installation of additional generating capacity or by the purchase of capacity. We estimate that the 1953 peak load will be 780,000 kw. If we are granted a license and construct the Roanoke Rapids project and also purchase the entire output of the Buggs Island development, we shall have a total dependable capability of 896,000 kw, which on our present estimates of load, would create a reserve capacity of approximately 15%. Capacity reserves of between 10% and 15% on a system such as ours are generally considered entirely normal and reasonable to provide for emergencies and unexpected load growth.

If our negotiations for the purchase of power from Buggs Island result in our obtaining only one-half of the output of that development, our reserve capacity in 1953 would be only about 9%, which is slightly less than we consider adequate.

In 1954, we expect a system peak load of 815,000 kw. With the Roanoke Rapids project in operation and assuming the purchase of all of the output of the Buggs Island development, [152] our reserve capacity would be approximately 10%, which is barely adequate and indicates the imperative need for additional capacity the following year.

The statements just made show the loads and the capacity requirements of the entire system. To show that the total capacity of both the Roanoke Rapids project and the Buggs Island development can be efficiently and economically used on the system, I wish to refer to a map of the system, which is similar to the system map presented previously as Exhibit 14.

* * * * *

By Mr. MOORE:

[157] Q. Will you now explain how the operation of the Roanoke Rapids project would be coordinated with the Buggs Island project?

A. Our studies indicate that only a small portion of the storage capacity of the Roanoke Rapids project will be necessary in order to properly coordinate the use of water at Roanoke Rapids with the discharge of water from Buggs Island. If we are sold the output of the Buggs Island project we will so coordinate

the schedule of deliveries of power from Buggs Island that the water released from that project will be efficiently used at Roanoke Rapids. If the output of Buggs Island [158] should be sold to other utility systems, private, R. E. A. or municipal, the release of water from Buggs Island will undoubtedly follow the same general pattern of operation as if we had purchased the power and the release of water would be such as to fit in with the planned operation of the Roanoke Rapids project. Any normal deviation from such planned usage can be readily taken care of by the use of the storage available at the Roanoke Rapids project.

Q. What existing systems are there in the Buggs Island area capable of purchasing and absorbing all of the Buggs Island power at the expected load factor?

A. Only the four power companies in the general area have systems capable of absorbing the entire output of Buggs Island at the expected load factor. These are Virginia Electric and Power Company, Carolina Light and Power Company, Duke Power Company, and Appalachian Electric Power Company. Of these, only Virginia Electric and Power Company and Carolina Power and Light Company will be the logical purchasers of the Buggs Island output. This is true because their systems are located in the immediately adjacent area with existing transmission lines extending practically to the Buggs Island site. To transmit the Buggs Island output to either Duke Power Company or Appalachian Electric Power Company would require substantial investment in new

transmission facilities or the transmission of power through the systems of the other two [159] companies for considerable distances.

Q. What is the situation as to absorption of power from the hydro development at Roanoke Rapids?

A. Here again, only the power companies are capable of absorbing the output of the Roanoke Rapids project at the expected load factor. In this case, however, the system of the Virginia Electric and Power Company appears to be the logical system to absorb the output of the Roanoke Rapids project. As I have described, the project lies at the center of the transmission network serving the Virginia Electric and Power Company system in that area.

Q. What is the situation as to the absorption of all the power from the hydro developments in the Roanoke River Basin contemplated in the comprehensive plan as contained in House Document 650?

A. The Roanoke River Basin is served by or is adjacent to the electric systems of the Virginia Electric and Power Company, the Carolina Power and Light Company, the Duke Power Company, and the Appalachian Electric Power Company. The total combined capacity of these four companies in 1953 is expected to be more than 4,000,000 kw. According to statistics recently published by the Federal Power Commission, these four companies in 1948 had peak loads totaling some 2,819,000 kw. If the load of these four companies continues to grow at the same conservative rate of increase used in estimating the [160] future loads of the Virginia Electric and Power Company, the

total load of these four companies in 1953 will be approximately 3,800,000 kw. On this basis the average increase per year will be approximately 200,000 kw. The total capacity of all of the developments, included in the comprehensive plan for the development of the Roanoke River Basin as described in House Document 650, is there shown to be 357,800 kw. It is therefore obvious that if the various sites are developed on any reasonable time schedule, the four adjacent utilities would have no difficulty whatsoever in absorbing the entire output of the Basin.

* * * * *

[442] Cross-examination by Mr. HANKIN:

* * * * *

A. I can't answer the question of how much we will store. We will store it in the pondage available in the project as designed, and naturally we will get the water from the river.

Q. Where will you get it?

A. From the river.

Q. Just from the river?

A. Yes.

Q. Natural flow?

[443] A. No, my studies have all been based on the flow as it would be released from the Buggs Island project.

Q. I am glad you made a study of that subject. Now, under those circumstances, can you tell me how much water you will need from Buggs Island in order to operate, as you stated just now, or as Mr. Holtz-

claw stated, for ten per cent, 20 per cent, 30 and 40 per cent of periods of low flow?

A. I have made no calculations along that line whatsoever.

Q. What calculations did you make in order to make sure that you would have enough water from Buggs Island to operate a peak load on heavy load hours and at storing point during the remaining hours?

A. You said what studies did I make?

Q. Yes.

A. I made my studies based on the results of information supplied us by our engineers, Charles T. Main, Incorporated.

Q. And Mr. Uhl stated that they made no studies?

A. Wasn't he talking about the design features of the plant when he made that statement? I thought he was.

* * * * *

Q. When you say they furnished you that information, did [444] they furnish it to you orally or in writing?

A. In writing.

Q. Do you have that information?

A. I do.

Q. Can you make it available to us so that we also will be able to see how you intend to operate that project, how much water you will have to have from Buggs Island?

A. It can be made available. I can't answer whether it will be made available or not. I would like to have some advice on that, your Honor.

* * * * *

[445] Q. On page 147 of the transcript you stated:

> During more than 90 percent of the time, the project would operate as a peaking generating station; that is, it would utilize the flow of the river to generate power on week days during the period from [446] approximately 7:00 a. m. to 11:00 p. m., during which time the project would discharge water at substantial rates varying up to the full capacity of the plant, approximately 18,000 c. f. s. During other hours of the week, the project normally would store the flow of the river passing such amounts of water as may be found necessary to maintain a minimum flow at least sufficient for municipal water supply, sanitation, and for the protection of fish and wildlife, which flow will always be as great as the minimum natural flow of the river and during certain seasons of the year may be substantially greater than the minimum natural flow.

If your releases of water are going to be greater than the natural flow, where will you get the water?

A. That water would come out of the reservoir of the Roanoke Rapids project.

Q. Will that be sufficient?

A. Not at all times.

Q. And for your peaking operations from 7:00 a. m. to 11:00 p. m., where would you get the water for that 90 percent of the time?

A. It will be a combination of the water that is in the pond, plus what is flowing into the pond.

Q. Can you give us any idea how much of each there will be, and what will be the source as between natural flow and [447] storage?

A. As has already been testified here, the Roanoke Rapids project does not have what is generally called storage in the large sense. It has what is called pondage. That is enough to equalize the variation of flow over a weekly period, say, and let you release it through the water wheels at the project in whatever way is desired.

Q. Now, considering that the natural flow is as much as 18,000 feet, about eight and a half percent of the time, would you say that you would depend to a very large extent on the storage at Buggs Island?

A. We would not be dependent on it at all for capacity. The storage at Buggs Island, if it is operated the way the Army Engineers contemplated it would be operated in their Definite Project Report, would increase the amount of energy available from the Roanoke Rapids project, but not any increase in capacity. That——

* * * * *

Mr. CARY. I was simply going to change the last word to "dependable" capacity.

* * * * *

[448] By Mr. HANKIN:

Q. You were going to change the word from "capacity" to "dependable capacity"?

A. Yes.

Q. In other words, it will not affect the dependable capacity?

A. That is correct.

Q. Just what do your mean by that? * * *

* * * * *

The WITNESS. By "dependable capacity," as distinguished from "installed capacity," I mean that amount of capacity which, as applied to any load to which it is going to be applied, and in this case I am talking about the load of the Virginia Electric and Power Company, that amount of capacity on which we can depend under the worst river flow conditions for carrying the company's peak loads.

* * * * *

Q. What would it be?

[449] A. 91,000 kilowatts.

Q. You mean all the time that you would have a natural flow you would have a dependable capacity of 91,000?

A. I do not mean that.

Q. Now, will you tell us what you mean?

A. I mean that as much of the time as our system load would require it, we could get 91,000 kilowatts out of that project.

Q. That means that with the water flowing out, you will still be able to operate from 7:00 a. m. to 11:00 p. m. every day, or we will say 90 percent of the time, at peak capacity?

A. I did not say that.

* * * * *

[450] The WITNESS. By my statement on page 147 of the transcript of the record here, I said:

> * * *. it would utilize the flow of the river to generate power on weekdays during the period from approximately 7:00 a. m. to 11:00 p. m., during which time the project would

discharge water at substantial rates varying up to the full capacity of the plant.

By that I meant the plant would be on the line generating whatever amount was required. During part of that time it might be very little; during part of the time it might be the full 91,000.

By Mr. HANKIN:

Q. For how long could you use 91,000 kw. during periods of low stream flow?

A. I don't know.

Q. Do you have any way of determining that?

A. I guess it could be determined, but as I see it, it would have no practical significance.

* * * * *

The WITNESS. I think if I knew exactly, it wouldn't mean anything, but I have no idea at the present time, and it would take considerable calculation to determine that.

[451] By Mr. HANKIN:

Q. We are willing to accept that as an answer because, Mr. Cary, isn't it true that it wouldn't be any more than about half an hour?

A. I have no way of knowing without making calculations.

Q. I believe you said you would have 91,000 kw. whenever you needed it.

A. That is correct; I did say that.

Q. For how long do you figure you would need it?

A. The full 91,000 kilowatts of capacity would only be needed during those short evening peaks that

occur in the winter months, the latter part of November, December, and January.

Q. For how many hours?

A. Usually about one hour per day.

Q. So you want to construct this project to meet that kind of a requirement?

* * * * *

[452] The WITNESS. That is one of the things we want to accomplish from the project.

* * * * *

By Mr. HANKIN:

Q. * * * How much capacity will you have for two hours during the low-flow period?

A. I can't answer that now.

Q. How about for one hour?

A. I have not studied this thing with the idea of finding out what I could do under hypothetical conditions. I have studied it to find out if the project will do what is required of it to do, as applied to the system of the Virginia Electric and Power Company.

Q. What are you required to do then, in the light of that system? What will this project do to meet the peak load conditions of the system?

A. It will carry the top 91,000 kilowatts of load on our system.

Q. For how long?

A. As long as is necessary.

Q. Then I am asking you during low flow periods for how [453] long is that necessary?

A. During the extreme low flow periods, the full 91,000 kilowatts will not be required at all. As I

stated, the full 91,000 kilowatts will only be required during the extreme peak load periods of the year.

Q. How long will you require it during those low-flow periods?

A. I answered that a little while ago: About one hour per day at the most, but not all of it every day.

Q. What do you call the low flow period, which part of the year?

A. The lowest flow period is the latter part of the summer and the early fall.

Q. And during that time you say you will need that capacity of 91,000 for only one hour a day?

A. No; I did not say that. I said during that period I would not need the full 91,000 kilowatts at all.

Q. How much will you need?

A. I don't know, but it is substantially less than 91,000.

Q. Substantially less can be what, 60,000 or 75,000? Would that be substantially less?

A. I can't answer that question the way you have put it because loads vary, of course, from year to year. Our other sources of supply vary from year to year.

In making our study we determined how much steam capacity [454] was necessary in order to carry the maximum peak, at the time of that peak. Then we assumed that those same facilities, whatever they are, were available during the rest of the time and we determined that the Roanoke Rapids project would carry that part of the system load in all months that could not be carried by those other facilties.

Q. Then in making those studies you must have made certain load curves?

A. Oh, yes.

Q. Can you furnish copies of those curves for the use of our engineers?

A. They can be supplied. I might add that the load curves, or rather similar data, is on file with the Federal Power Commission and can be available to anybody that wants them. That is where the Army Engineers got it.

Q. You can make the load curves that you used for this study available?

A. I can.

Q. And will you do it?

* * * * * *

[455] Q. You understand we want the exact data you used in arriving at your conclusions.

A. That is available.

* * * * * *

[458] Q. So that under all circumstances you would say the operation of Buggs Island would be such that you would be able to operate at peak load from 7:00 a. m. to 11:00 p. m., and get the necessary storage, whether the Secretary operated one [459] way or another, so that so far as being assured of releases of water is concerned, you can say to the Secretary that, "We don't need to enter into any arrangement with you"? Is that correct?

A. I would like to repeat what I did say, or at least what I meant, anyhow.

* * * * * *

The WITNESS. I said, we have assumed in our studies that the power output of the Buggs Island Project would be used to supply some sort of utility system load and that if it is operated that way we would not have to worry about how the water came to the Roanoke Rapids project.

By Mr. HANKIN:

Q. Yes; and therefore I asked you, supposing it would not operate in that way? After all, you have no assurance.

A. It is entirely possible.

* * * * *

[472] The WITNESS. I would like to have the question repeated; do I agree with the statement?

By Mr. HANKIN:

Q. Yes.

A. I agree with the statement except to this extent: I have no way of checking the 300 per cent, and he used the word "power." I think he meant "energy." The Buggs Island project will increase the energy output from the Roanoke Rapids project but it does not increase the dependable capability as applied to the system of the Virginia Electric and Power Company.

Q. Do you make a distinction between energy and power output?

A. I certainly do.

Q. He further states in that letter that, "The licensee in consideration of any benefits which it may receive from headwater improvements of the United

States, shall reimburse the United States for such benefits." In view of this statement what, in your judgment, would constitute the money equivalent of the benefits that you would receive?

A. I have already answered that question.

[473] Q. You mean what?

A. $261,000 as the maximum possible benefits.

* * * * *

Exhibit 52, Sheet 1

Buggs Island projects, apportionment of reservoir costs to Roanoke Rapids

Item		Estimated cost June 1, 1948
Dam and appurtenances		[1] $27,220,000
Alterations and relocations		18,390,000
Lands and damages		7,240,000
Reservoir clearing		6,440,000
Subtotal		59,290,000
Apportioned cost of preparing definite project report		[2] 260,000
Apportioned cost of preparing plans and specifications		[3] 1,600,000
Total cost of reservoir		61,150,000
[1] Definite project report estimate (pg):		
Dam and appurtenances		$18,710,000
Powerhouse and switchyard		11,700,000
Total		30,410,000
Estimate of June 1, 1948:		
Dam, powerhouse and switchyard		44,260,000
44,260,000/30,410,000=1.455.		
18,710,000×1.455=27,220,000.		
[2] Total cost preparation definite project report		$340,000
Power plant cost (from Note 1) 11,700,000×1.455=$17,020,000		
Direct reservoir cost	59,290,000	
	76,310,000	
340,000×59,290,000/76,310,000		260,000
[3] Total cost preparation plans and specifications		$2,200,000
Direct costs:		
Dam and appurtenances	$27,220,000	
Alterations and relocations	18,390,000	
Subtotal	45,610,000	
Powerhouse and switchyard	17,020,000	
	62,630,000	
$2,200,000×45,610,000/62,230,000		1,600,000

Buggs Island projects, apportionment of reservoir costs to Roanoke Rapids—Continued

[4] Annual flood control benefits	$735,000
Operation and maintenance chargeable to flood control	113,000
	622,000
$622,000 capitalized at 3 percent interest, 50-year amortization = $16,000,000 investment construction cost allocated to flood control 16,000,000/1.09 = $14,680,000.	
[5] Estimated operation and maintenance expense from definite project report	$306,000
Increase 10 percent for wage increases	31,000
Present estimate of operation and maintenance expense	337,000
Operation and maintenance chargeable to flood control	113,000
Operation and maintenance chargeable to power	224,000
Operation and maintenance of power plant	134,000
Reservoir operation and maintenance to power	90,000

Exhibit 52, Sheet 2

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, 25 March 1949.

Address reply to: Chief of Engineers, U. S. Army, Washington, D. C.

Refer to File No. ENGWF.

DIRECTOR, *Division of Power,*
Department of the Interior,
Washington, D. C.

DEAR SIR: Reference is made to letter dated 24 February 1949 from the Acting Regional Engineer, Division of Power, and addressed to the District Engineer, Norfolk District, Corps of Engineers, requesting the latest official estimates of cost and flood control benefits for the Buggs Island and Philpott projects.

The latest estimates of cost for these projects are inclosed. Inasmuch as these estimates are based on contracts which have been let or scheduled, in which

costs of specific power and other features have not been separated, an itemized breakdown of these costs has not been included.

Annual flood control benefits are presently estimated at $735,000 and $264,000 for Buggs Island and Philpott, respectively.

For the Chief of Engineers:

Sincerely yours,

H. C. GEE,

Lt. Col., Corps of Engineers,

Deputy Chief of Civil Works for Flood Control.

2 Incls: 1. Buggs Island estimate of cost. 2. Philpott estimate of cost.

Exhibit 52, Sheet 3

Buggs Island Reservoir Cost Estimate, June 1, 1948

Description		*Estimated Amount*
Dam, powerhouse and switchyard:		
Work completed	$2,810,000	
Work in progress:		
Construction contracts	16,720,000	
Supply contracts	7,810,000	
Work to be initiated:		
Construction contracts	7,810,000	
Supply contracts	9,110,000	
Total, dam, powerhouse, and switchyard		$44,260,000
Alterations and relocations (work to be initiated):		
Railroads	6,170,000	
Highways	10,620,000	
Utilities	320,000	
Urban areas	1,280,000	
Total, alterations and relocations		18,390,000
Lands and damages (work completed or in progress)		7,240,000
Reservoir clearing (work to be initiated)		6,440,000
Definite project report		340,000
Plans and specifications		2,200,000
Total estimated cost, Buggs Island Reservoir project		78,870,000

NOTE.—Estimate is based on price levels prevailing in May 1948 and includes allowances for contingencies, inspection and supervision, and overhead.

TESTIMONY OF MR. CARY

DIRECT EXAMINATION

* * * * *

[132] Q. Have you made a study to determine whether the proposed project is economically advantageous for construction by the Company?

A. I have.

Q. Have you set forth your findings and conclusions in a table which you are prepared to introduce as an Exhibit?

A. I have.

Q. Is this tabulation which we now hand you the summary of the results to which you refer?

A. It is.

Q. Do you believe the facts to be correctly stated on this exhibit?

A. I do.

[133] Mr. MOORE. We ask this exhibit be received in evidence as Exhibit Number 15.

By Mr. MOORE:

Q. Will you now proceed to explain the basis upon which economic feasibility is examined by this study?

[134] A. This study is based on the comparison of a power supply program using power from the proposed Roanoke Rapids Project No. 2009 as compared with the program of power supply using steam capacity which it is estimated would be used as an alternate if the Roanoke Rapids project is not developed in the near future.

Q. Will you review the essential features entering into the comparison thus made?

A. The tabulation shows the capability of the proposed Roanoke Rapids project as 91,000 kw. as stated in the amended application which it is estimated will be the dependable capability of the project. The project will have the effect of increasing the dependable capability of the small existing hydro station of the Company at Roanoke Rapids from 3,000 kw. to 5,000 kw. as shown giving a total dependable capability for the two stations of 96,000 kw.

The tabulation bases the economic comparison between hydro and steam on an annual energy output from the project of 345,000,000 kw.-hrs. This is computed from the estimate of output furnished us by our engineers, Chas. T. Main, Inc. In order to make a complete and accurate analysis, we have divided

the estimated annual energy output into that which would be generated during the on-peak periods and that which would be generated during the off-peak periods for both stations. These figures are shown in the tabulation for both [135] stations. In the equivalent steam program we have assumed steam capacity which would supply the same amount of dependable capability and the same total amounts of on- and off-peak energy.

This tabulation states an investment of $25,085,000 for the power development for the hydro project. This investment includes all of the items set forth in the Amended Application except the step-up substation which is included in the tabulation together with required step-down substation investment. The values for the power development and the step-up substation include those given in the Amended Application, which are the estimates prepared for the Roanoke Rapids project by the Stone & Webster Engineering Corporation working in conjunction with Chas. T. Main, Inc. The values given in the tabulation also include additions for the Company's local administrative and engineering costs and interest during construction, as contemplated by Sheet 3 of Exhibit N in the Amended Application. The values for the required step-down substation and the transmission line investment included in the tabulation are estimates prepared by the Company's engineers. The hydro program would require two 110,000 volt transmission lines from the project to the Company's existing Roanoke Rapids substation, a distance of approximately 1.6 miles, and an additional circuit

installed on an existing steel tower line from Roanoke Rapids to Suffolk together with the [136] necessary switching facilities at the Company's Roanoke Rapids and Suffolk substations.

To determine the installed cost of capacity under the equivalent steam program, we have used the actual cost of the recently completed first unit of the Possum Point Power Station near Quantico, Virginia, with a dependable capability of 74,000 kw. and the recently revised estimate of the cost of the addition of one unit, with a dependable capability of 74,000 kw. now nearing completion at the Chesterfield Power Station near Richmond. The Chesterfield and Possum Point stations are both designed for ultimate extension to six units, and it is assumed that any new steam station would be of similar design and cost. Using the actual cost of Possum Point and this revised estimate of cost of the Chesterfield extension, we have estimated the cost of two, three, and four unit stations, and for this evaluation have used the cost of a three unit station to determine the cost per kilowatt, as that appears to represent a fair average between the high cost per kilowatt of an initial one unit station and the lower cost per kilowatt of an ultimate six unit station. In determining this cost per kilowatt of steam capacity we have used the actual practical net capability of the station as a whole, which operating experience has proved to be reasonable in carrying the peak load. The cost of steam capacity thus determined is $129.20 per kilowatt or $11,757,000 for the equivalent steam [137] program.

The item of $1,324,000 for step-up and step-down substations under the equivalent steam program includes a 20,000 kva synchronous condenser at the existing Roanoke Rapids substation together with the necessary switching equipment for a transmission line to connect the steam capacity into the Company's transmission system. In the equivalent steam program, we have included approximately 20 miles of 110,000 volt transmission line which it is assumed will be necessary to properly connect this capacity into the Company's transmission system.

The cost estimates for both substations and transmission lines are based on the experience of the Company in recent construction.

This results in a total estimated investment for the equivalent steam program of $13,581,000 as compared with the total for the hydro program of $26,738,000.

The assumed financing of 55% debt securities and 45% equity capital has been used since that appears to represent the actual ratio that has existed in the past and is expected to exist in the future. Permissible net return on investment has been taken at 6%. Interest on debt is estimated at 3% in the light of current experience in utility financing. The next four items cover the determination of Federal Income Tax. Depreciation in the study is based on the 6% compound interest [138] sinking fund method, using an average life for the hydro station of 58 years, for the steam stations 35 years, for substations 30 years and for transmission lines 30 years for wood poles and cross-arms, and 50 years for all other items.

Property taxes have been estimated on the basis of the actual assessing practices and rates in the actual localities involved.

This results in total annual charges and taxes, based on the investment only for $2,690,000 for the hydro program as compared with $1,402,000 for the steam program.

The next item is our estimate of the operating and maintenance expenses which will be incurred in connection with the various substation equipment and transmission lines included in each of the two programs.

The next item in the tabulation, fixed station operating and maintenance expenses other than fuel, is based for the hydro program on the actual expenses of a somewhat similar hydro power station with certain adjustments which appeared advisable in order to reflect a long time average rather than a single year. For the equivalent steam program this estimate of expense is based on a careful analysis of the actual expenses of our own Chesterfield Power Station, which has been in operation since 1944, with the necessary adjustments to reflect the conditions which would exist in a three unit station. The variable station operating and maintenance [139] expenses other than fuel have been determined in the same manner.

Our estimates of general and administrative expenses and payroll taxes have been determined from a careful analysis of the Company's actual expenses for the year 1948 eliminating certain items which in our opinion are not properly included as they are not

a function of the Company's plant investment or operating expenses. For this item we have used 12.7% of the total operating and maintenance expenses other than fuel in Virginia and 13.3% in North Carolina, the principal difference being the difference in unemployment taxes in the two states.

We have included as the next item an estimate of the additional general and administrative expenses and license fee which will be incurred under the hydro program which will not be incurred in the equivalent steam program.

Fuel expense for the alternate steam program is based on a cost of $5.50 per ton of coal f. o. b. mines and having a heat content of 14,000 B. t. u. per pound. To this cost we have added a freight rate of $3.59 and $0.25 per ton which is the average cost to the Company for coal handling and shrinkage. Our estimate of fuel consumption is based on our actual experience at the Chesterfield steam station and is based on an on-peak increment of 11,550 B. t. u. per kilowatt-hour and an off-peak increment of 9,800 B. t. u. per kilowatt-hour.

By addition the total annual cost is found to be $2,829,000 **[140]** for the hydro program as compared to $3,233,000 for the steam program, an excess of annual cost of the steam program over the hydro program of $404,000.

This analysis has been based on the assumption that all Buggs Island power would be sold to the Company. If only half is sold to it, the Roanoke Rapids hydro program compares more favorably with the steam alternative because there would be

eliminated from the hydro program the second circuit from Roanoke Rapids to Suffolk and accompanying substation facilities. There is no further change in the comparison of hydro to steam for the Roanoke Rapids project if none of the Buggs Island power is sold to the Company.

Q. Are there any advantages to the Company from the Roanoke Rapids project which have not been included in your evaluation?

A. Yes, there are several advantages for which it is extremely difficult to establish a monetary value. As previously stated, the location of the Roanoke Rapids project at the center of a load area and at the center of an existing transmission network will increase to some extent the reliability of power supply in that area by providing generating capacity locally and make the area less subject to interruptions or disturbances caused by transmission line outages.

The substantial size of the capacity provided by the project will also improve to some extent the voltage regulation **[141]** in the area.

The operation of such a peaking hydro station will make a decided improvement in the light load operating conditions of the Company's larger steam generating units throughout the system. These large generator units and boilers operating at higher pressure and temperatures are not readily adaptable to operation at extremely light loads and neither are they adaptable to frequent stopping and starting on account of the resultant expansion and contraction of their component parts. Such operation would result in greater maintenance cost and undoubtedly reduced life of the

equipment. The relation of our on-peak and off-peak loads is expected to be such in the near future that with the addition of several large steam units the operation of the steam stations during light load periods will become a serious problem. The Roanoke Rapids project will make unnecessary a similar amount of steam capacity that would otherwise be required without aggravating this off-peak operating problem as there are no difficulties in reducing a hydro generating station to extremely light loads.

Q. In view of your evaluation of the capacity and energy to be obtained from the proposed Roanoke Rapids project, will you now state whether the proposed project is economically feasible and desirable for development by the Company, in comparison with the cost to the Company at its other power plants throughout its system, and in comparison with other power [142] supply that might be developed or made available?

A. Yes. In my opinion the project is economically feasible and a very desirable development for the Company because, as shown in Exhibit 15, the cost to the Company will be substantially less than if the same amount of capacity is made available by installing the same type of steam capacity as is currently being installed by the Company and also because the project, on account of its location almost adjacent to our existing substation at Roanoke Rapids and at the center of our transmission network in the southern part of the system, will substantially improve the quality and reliability of service rendered in that area.

In regard to its economical feasibility in comparison with other power supply which might be developed or be made available, the alternate steam program used in Exhibit 15 is in my opinion the program which gives the lowest over-all cost of any other power supply program that the Company might use as an alternate to the hydro program.

Q. Turning now to Exhibit H, filed with the amendment to the application, entitled "Statement of Effect of Proposed Operation of Project," will you now comment in more detail than the statement in Exhibit H as to the manner and effect of the proposed operation of the project and, in this connection, point out how the project would be operated to result in maximum conservation and utilization of the available water resources in the region affected for the purpose of power, [143] navigation, irrigation, reclamation, flood control, fish and wild life protection, municipal water supply, and sanitation?

* * * * *

[147] A. Neither irrigation nor reclamation is involved in any project or basin plan or in the plan contemplated by HD 650. We have given considerable study to the manner in which the project would be operated. During more than 90% of the time, the project would operate as a peaking generating station; that is, it would utilize the flow of the river to generate power on week days during the period from approximately 7 a. m. to 11 p. m. during which time the project would discharge water at substantial rates varying up to the full capacity of the plant, approximately 18,000 c. f. s. During other hours of

the week, the project normally would store the flow of the river, passing such amounts of water as may be found necessary to maintain a minimum flow at least sufficient for municipal water supply, sanitation, and for the protection of fish and wildlife, which flow will always be as great as the minimum natural flow of the river and during certain seasons of the year [148] may be substantially greater than the minimum natural flow. For the protection of navigation at Weldon, North Carolina, and below, the increase and decrease in the discharge of water from the project will be so controlled as to avoid dangerously rapid rise or fall of the water level at Weldon.

* * * * *

[476] Cross-examination by Mr. HANKIN (interrupting):

Q. Mr. Witness, will you turn to your Exhibit 15?

A. I have it.

Q. Will you look at the figures, interest on debt? How much is given for the hydro plant and how much for the steam plant?

A. For the hydro——. I would like to make one statement before I answer that.

Q. Answer my question first, then make your statement. I am entitled to an answer.

A. The figure shown on Exhibit 15 opposite that item under the hydro program is $441,000. Under the equivalent steam program $224,000.

Q. And how much would be available to add for earnings on [477] the preferred and common stock, in accordance with that exhibit?

A. The exhibit makes no such statement.

Q. Doesn't it, Mr. Witness?

A. If you were referring to the item there, "Permissible net return on investment"—is that the item to which you were referring?

Q. That is one of the items, but you have another item, "Balance for Federal Income Tax." What does that "Balance" mean?

A. That balance——

Q. I beg your pardon, "Balance for Surplus."

A. That is the difference between the permissible net return and the interest on the debt.

Q. And that is how much?

A. For the hydro program it is $1,163,000, and for the equivalent steam program, $591,000.

Q. With these figures, can you tell me whether your security holders would benefit more by the hydro plant than by the steam plant?

A. In my opinion they would not.

Q. Would you explain that?

A. Because we are regulated by the various state corporation commissions and they control our earnings, regardless of what program we follow. The return on the investment I assume would be the same.

[478] Q. But the amount of investment would be greater, would it not, in the case of hydro rather than steam?

A. That is correct.

Q. Therefore, the amount in actual dollars and cents, will your security holders benefit more by the construction of the Roanoke Rapids project than by an equivalent steam plant?

The WITNESS. * * * Naturally, there would be more dollars and cents paid out. I was thinking about per dollar investment.

[479] By Mr. HANKIN:

Q. Can you tell us by how much more they would benefit if the hydro project were constructed than if a steam plant were constructed?

* * * * *

The WITNESS. The answer to the question would be that the interest paid under the hydro program, that is, the interest paid on debt under the hydro program, would be $441,000, as compared with $224,000 under the equivalent steam program. The [480] balance for surplus would be, under the hydro program, $1,163,000, as compared with $591,000 under the equivalent steam program.

Mr. MOORE. While you are on it, let's give the estimated investment.

The WITNESS. The estimated total investment in the hydro program is $26,738,000, whereas the total investment required under the equivalent steam program is $13,581,000.

By Mr. HANKIN:

Q. You still have not answered the question I asked you, and that is the total benefit to your security holders under hydro as compared with steam.

* * * * *

REDIRECT EXAMINATION

[495] Q. Mr. Cary, do you have before you a copy of Exhibit 28 that was marked for identification this

A. I do.

Q. Mr. Hankin made some inquiry of you as to whether you were in a position to make a computation as to what would be the effect on the figure at the bottom of that sheet, $143,000, if you assumed in the column headed; "Equivalent Steam Program," [496] instead of 93,000, 91,000. Is that a practical computation to make within any short period of time?

A. No, it would take considerable time to do it accurately.

* * * * *

Q. Will you state why the figure 93,000 was used in making this comparison, instead of 91,000?

A. That is because a fair comparison would not have been obtained if I had used 91, because I am comparing here the results from the hydro program involving the project under consideration and an equivalent steam program with the assumption that Buggs Island were not in existence.

It is a fact that as a result of the construction of the Roanoke Rapids project that the capacity, the dependable capacity of the existing plant immediately downstream from it will be increased from 3,000 kilowatts to 5,000 kilowatts, and if I did not take that into consideration in this calculation I would have a comparison that would be, in my opinion, meaningless and impractical; it would not show the true facts.

[497] So in order to make the comparison show the true comparison, I have to credit the hydro program with that extra 2,000 kilowatts. By the same token over in the equivalent steam program I do not have

that 2,000 kilowatts in my existing plant, so to have an equivalent program I have to put additional steam capacity in to make it a logical comparison.

Q. You had referred in your testimony this morning to the investment involved in the two cases, 26 million plus for the hydro project, and 13 million plus for the steam project, with the resulting differences in interest charges and balances. Will you also state what are the differences in the amount of Federal income taxes that would be payable to the Federal Government in connection with the two projects?

A. Under the hydro program the estimated Federal income tax would be $1,879,000, whereas, in the equivalent steam program——

Q. Wait a minute, you are on the wrong line, I think.

A. I would like to correct that statement. I read from the wrong line.

The estimated Federal income tax under the hydro program would be $714,000, whereas, under the equivalent steam program it would be $367,000. That is, assuming that the present Federal income tax rate applies.

Q. Now, what would be the difference in the local property taxes in the two cases?

[498] A. Under the hydro program local property taxes would be $302,000, whereas under the steam program they would be $57,000.

Q. In other words, under the hydro program the Federal and State governments would receive in taxes more than a million dollars, as compared with $434,000 on the equivalent steam?

A. That looks like it is correct.

Q. However, you just have a project about twice the size in investment all the way through, do you not, in the hydro?

A. Approximately.

Q. Mr. Cary, you said you made quite a distinction between energy and power output. Will you explain that?

A. The term power is measured in kilowatts and is a rate of either generation or use of energy. Whereas energy is the total product used over a period of time.

Q. If any reasonable use were made of the Buggs Island project, considering the installed capacity, storage, inflow to the reservoir, could you use the Roanoke Rapids plant to supply the 91,000 kw. of dependable capacity on the load of the company?

A. Yes.

Q. If the Secretary of the Interior undertook to market the surplus power from Buggs Island in conformity with the policy laid down in Section 5 of the Flood Control Act, which requires [499] that, quoting, such power should be "disposed of," "Dispose of such power in such manner as to encourage the most widespread use thereof at the lowest possible rates to consumers consistent with sound business principles," could you use the Roanoke Rapids plant to supply the 91,000 kilowatts of dependable capacity on the load of the company?

A. Yes.

* * * * *

Re-cross-examination by Mr. HANKIN:

Q. Mr. Cary, do you treat your income taxes and property taxes as an operating expense?

A. I am not an accountant.

Q. Well, you are well acquainted with your operation, are you not?

A. In my opinion it is an expense.

Q. How is it treated on the books, do you know?

A. I think it has the effect of being an expense, whether it is technically considered an expense on our balance sheet I am not prepared to say.

Q. For rate-making purposes you would not urge that the amounts that are paid for income and property taxes should not be included as deductible from the revenues, would you?

A. I certainly would not.

* * * * *

[500] Q. So that these amounts are included in rates which are paid by your consumers?

A. I am certainly under that impression, and I think that is very true.

Q. So that the amount of income and property taxes is not really paid by you, it is paid by the consumers?

A. I think that is correct.

Q. Now, I believe you just testified that with the Buggs Island project out, the dependable capacity of your 6,000 kw. project is something like 3,000 kw.?

A. Without either Buggs Island or the Roanoke Rapids project.

Q. That is right. Now, with Buggs Island in the existing dependable capacity is increased to 5,000?

A. That is correct.

Q. In other words, an increase of something like what percentage? About 66⅔ per cent, is it not?

A. That is right, 66⅔.

[501] Q. And yet you say the dependable capacity of the Roanoke Rapids project would not be increased by the existence of the Buggs Island project?

A. That is what I stated, and that is what I believe to be tr[illegible].

* * * * *

Testimony of Mr. Hamilton

Direct Examination

[984] Q. Do you consider the Roanoke Rapids a desirable hydro-electric project without Buggs Island?

A. No.

Q. Will you explain why that is so?

A. The low water flow of the river is such that the proposed 91,000 kw. project of itself would be lacking in sufficient firm energy and dependable capacity.

Q. On what do you base this conclusion?

A. On the amount of water required by the plant and on the stream flow records appearing in Water Supply Papers of the U. S. G. S.

Q. Have you prepared an exhibit which is marked for identification as Exhibit No. 51?

A. I have.

Q. Would you please explain this exhibit?

A. This exhibit was made up for the purpose of showing the flows of water necessary for capacity operation and down- [985] stream requirements. The flow of water considered necessary was placed at 18,050 c. f. s., and 1,000 c. f. s. was employed as the

minimum flow of water that would be permitted downstream from the plant.

In the first column is set out the use of flow of 18,050 c. f. s. The second column indicates the number of hours it would have to be run, so as to bring up the flow to 18,050 c. f. s.

The next column indicates the number of hours that 1,000 second-feet woud have to be passed down the stream.

The next column is the total of 18,050 c. f. s. multiplied by the times it would be used.

The next column covers the hours times 1,000 c. f. s. that 1,000 c. f. s. would be used.

The next column gives the total amount of water that would be required in 24 hours.

The next column gives the amount of water that would be required each day if the project was only operated five days per week.

The next column gives the time that the investment would be used, and the next column is the number of months where the flow given in the eighth column, would be less than the five-day c. f. s. flow.

The next column is the application of the five-day flow to the normal duration curve.

[986] Q. What is the significance of Sheet 2 attached to Sheet 1 of Exhibit 51?

A. The purpose of that was to show that a plant operating 16 hours a day and requiring 9,192 c. f. s., would be without the full amount of water necessary for that operation in many months of the 34 years and 9 months of record.

* * * * *

You will note, for example, instead of 9,192 c. f. s., that in 1912 we have one month of only 2,200 c. f. s., in August. In 1914, we have one month with 2,980; in August, 2,370; in September, 1,480.

In September of 1916, we have but 2,440 second-feet, and in 1917, in October, we have 2,530 second-feet, and in December, [987] 2,190 second-feet.

In 1918, we have in October, 2,250 second-feet, and in 1919, 2,340 second-feet.

In 1921, in August, we have 2,430; September, 2,290; October, 1,570.

In November of 1922, we have 2,180 c. f. s. In 1923, we have 2,930 c. f. s. In 1925, we have 2,580 in July; 2,770 in August; 2,490 in September; 2,790 in November.

By Mr. HANKIN:

Q. You mean October?

A. October. In 1926, we have 2,320 in June; 2,640 in August; 1,730 in September; 1,730 in October.

* * * * *

The WITNESS. I desire to point out that these low flows [988] occurred in different years, in different months of the year, and that they occur in sequence in many of the years.

CHIEF PRESIDING EXAMINER: I see in 1930, in October 4, the flow was 940.

The WITNESS: That is right.

* * * * *

Q. Now, on page 147 of the transcript, Mr. Cary testified that the plant, if constructed by the applicant, would run from 7:00 a. m. to 11:00 p. m., and would

shut down the rest of the day, also on Saturdays, Sundays, and holidays, has the project sufficient average annual dependable capacity for 16 hours per day, excluding Saturdays, Sundays, and holidays to warrant its construction?

A. In my opinion a 91,000 kw. plant, without Buggs Island, [989] would not have sufficient dependable capacity for operating through 16 hours per day to warrant its construction.

Q. If the plant is to be so operated, what would be be the average flow of water necessary to permit such operation?

A. 9,192 second-feet.

Q. Will you please refer to the flow duration curve, which is Exhibit I to the amended application, and state what percentage of the time that flow would be available?

A. Twenty-five per cent of the time.

Q. Would you conclude from that that the Roanoke Rapids project does or does not have engineering feasibility to meet the operating schedule without Buggs Island in operation 16 hours per day?

A. It does not.

Q. What, in your opinion, is necessary to make the Roanoke Rapids project feasible?

A. Three requirements are necessary. There must be sufficient upstream storage to increase low flows and retard high flows.

The discharges of the upstream storage allocated to power must be controlled for the benefit of the downstream project.

And the over-all operating costs of the Roanoke Rapids project must be lower than like capacity and energy could be secured elsewhere.

Q. To your knowledge, does the applicant have sufficient [990] storage at Roanoke Rapids to meet the requirements?

A. No, he does not have storage; he has pondage.

Q. To your knowledge, does the applicant have any upstream storage facilities?

A. Not to my knowledge.

Q. Under whose ownership is the storage at Buggs Island?

A. The United States.

Q. Under whose control is the storage at Buggs Island that is allocated to power?

A. The Secretary of the Interior.

Q. Do you know whether the applicant and the Secretary of the Interior have entered into any contract whereby the applicant will be assured of the control of releases from Buggs Island to meet the needs of operation at Roanoke Rapids?

A. I have been advised that no such contract exists.

Q. And in your opinion, is such a contract necessary in order to assure the operation of Roanoke Rapids, as testified by Mr. Cary?

A. It is, for the reasons mentioned, and for the further reason that preferred customers would have to have energy around the clock on Saturdays, Sundays, and holidays, and other customers of the project may also need power at night and week-ends. This operation would call for a different release of water than contemplated by the applicant.

Q. Have you examined Exhibit 15 and noted the amount of [991] investment and the annual cost which would be involved in the development of Roanoke Rapids by the applicant?

A. I have.

Q. In your opinion, would it be a prudent investment on the part of the applicant to proceed with the construction of Roanoke Rapids without making provision for enjoying and paying for the benefits that would result from the construction and operation of the Buggs Island project?

A. It would not.

Q. Would you explain why it would not?

* * * * *

The WITNESS. Because the flow of water is such that the use of the investment would be limited. And if the possible payment of benefits is not predetermined and set up as an expense the applicant is not fully aware of the annual cost of the project to it.

Furthermore, there is a large increase in investment over [992] other costs of power. The investment set up in Exhibit 15 is $26,738,000 for the cost of the Roanoke project, while investment in a steam plant is stated to be $13,581,000. This difference of $13,157,000 is far too great to be ignored as a lower cost source of power.

Then, again, a steam plant has many advantages over those of the proposed hydro plant. Consequently, in my opinion, it would be uneconomical for the applicant to proceed with the development.

When a development is made in a new steam plant, there is no risk as to the capabilities of the steam plant, both as to delivery of energy and capacity, while in the hydro as proposed, even with controlled storage, risk is involved in the amount of assumed capacity, the amount of energy, and in the annual cost of the project. The greater the risk in the investment, the greater must be the cost of money with which the investment may be made. This may mean adding to the annual cost of operation and it means that the public will have to pay an amount substantially greater than it set forth on Exhibit 15, or on Exhibit 23.

Since the margin of feasibility is very small, the probabilities are that even according to the annual cost figures without the annual benefits being assessed, the project will be infeasible.

The fact that the benefits may fall between $261,000, as [993] stated by the applicant, and the benefits to the United States which may amount to a million dollars, must, of course, enter into any calculation of cost.

Furthermore, the steam plant can turn out from 25 to 50 percent more power than the hydro plant with allowance for time out for overhauling. A new steam plant will permit of its being operated further down on the load curve than less efficient plants being used on the peak.

Q. Taking up the Roanoke Rapids with Buggs Island in operation, but without a firm contract coordinating and integrating the operations of Buggs

Island with those of Roanoke Rapids, what can you say about the feasibility of the Roanoke Rapids project?

A. The feasibility of the project would certainly be less without positive control of storage, and since the percentage of feasibility is small, being 1.143, according to Exhibit 15, and 1.115, according to Exhibit 23, the less degree of feasibility would probably result in rendering the project infeasible.

* * * * *

[996] It is improper to hope that Buggs Island will be operated to the same load curve over a period of 58 years for and in a way most beneficial to Roanoke Rapids. Here again when risking an investment of $26,000,000, the least the applicant should do is to first secure a firm contract to the control of the water releases from Buggs Island. Even contracts do not always survive a period of 58 years, but this safeguard is the least that must be had if such an investment is made.

Q. I notice you talk about the small degree of feasibility of the applicant's project without considering downstream benefits. That is the significance of that statement in terms of the downstream benefits which should be assessed against Roanoke Rapids?

A. I have already testified that the Roanoke Rapids project of itself is without dependable capacity to operate 91,000 kilowatts at 16 hours, for five days a week. On the other hand, if Buggs Island storage is released as desired by the applicant, it has been testified that the applicant will secure 91,000 kw. of

dependable capacity. It has been testified that the applicant's peak comes in December. That is the time when dependable capacity is most valuable to the applicant and no doubt to the power phases of the Buggs Island development. The United States Engineers placed their dependable capacity at Buggs Island in December at 90,000 kilowatts. You will note that the dependable head of both projects [997] in the month of December will approximate the same, 72 in one instance, 74½ in the other. During this period the head on the Buggs Island project will be lower than at Roanoke Rapids.

The water passing each power plant will be practically the same. However, the storage may not be released as desired at the very time it is needed by the applicant.

A dam of 144 feet in height will have been constructed at Buggs Island. Furthermore, in case of an unusually low-water period the dead storage in Buggs Island could be made available to further assure the dependable capacity at Roanoke Rapids and in high water the flood control features will preserve power head at Roanoke Rapids and assure less waste of energy.

Since the storage at Buggs Island will be utilized to practically the same extent by both Roanoke Rapids and Buggs Island, the least measure of evaluating the downstream benefits to Roanoke Rapids resulting from storage water at Buggs Island would be to divide the cost of storage equally between the two projects.

Q. You are acquainted with Exhibit 9, which is the letter written by the Chief of Engineers to the Federal Power Commission?

A. I am.

Q. What is the total estimated cost of Buggs Island [998] project at the present time?

A. $78,870,000.

Q. How much are the annual charges?

A. $3,811,000.

Q. What is the amount of power benefits set up for Buggs Island?

A. $3,762,000.

Q. What bearing do these figures have on downstream benefits?

A. They indicate that the downstream benefits are bound to be quite large.

Q. Have you prepared an exhibit showing how much that would amount to as an annual cost to be used as a measure of the cost of benefits to Roanoke Rapids?

A. Yes, I have.

Q. Is that the exhibit marked for identification as "Exhibit 52," having three sheets?

[999] A. 52, sheet 1?

Q. Yes.

A. Yes, sir.

Q. Will you explain this part of the exhibit?

A. The estimated cost as of June 1, 1948, has been given for the dam and appurtenances, alterations and relocations, lands and damages, and reservoir clearing.

Q. How much is that total?

* * * * *

A. $59,290,000. The apportioned cost of preparing the Definite Project Report has been placed at $260,000. The apportioned cost of preparing plans and specifications has been placed at $1,600,000. The total cost of the reservoir has been placed at. * * * $61,150,000, and that which is allocated to flood control, $14,680,000. The amount allocated to power is placed at $46,470,000, to which interest during construction on a 2 percent basis has been added, which brings the total cost of investment up to $49,260,000.

The amortization and interest at 2 per cent, on a 2 per [1000] cent basis for 73 years gives a cost of $1,290,000, and the reservoir operating and maintenance expenses chargeable to power amount to $90,000.

The total annual reservoir cost to power is placed at $1,380,000. If one-half of this amount is apportioned to Roanoke Rapids it amounts to $690,000.

Q. And the footnotes explain how you arrived at these figures; is that correct?

A. Yes, sir.

Q. What is the significance of the assessment of downstream benefits in relation to the feasibility of the applicant's project?

A. You will note that the net power benefits of Buggs Island are within $49,000 of the total annual cost. The United States should be reimbursed for the Buggs Island project in the amount of $3,762,000 per year. This amount can be returned in two ways, either by charging the purchasers of Buggs Island power with the amount of $3,762,000, or by charging

the purchasers of power from Buggs Island $3,762,000, less the benefits from Roanoke Rapids.

The applicant in its testimony has given the excess of annual cost of steam power over hydro. The downstream benefits when assessed will constitute an additional cost of the hydro power and the net difference between hydro and steam will be diminished by the amount of benefits assessed.

[1001] In other words, the feasibility of the project is reflected not in the figure of $404,000 as shown on Exhibit 15, but by $404,000 minus $690,000. In other words, the project is not feasible.

Q. What would be the effect if downstream benefits are not assessed against Roanoke Rapids and the consumers of Buggs Island power are not charged with this amount?

A. The result would be the same as subsidizing the applicant in the amount of $690,000 per year.

Q. Would that be fair?

A. I believe this would be unfair because the assured basis of a continued water supply, both of the Buggs Island power plant and the Roanoke Rapids, is the storage at Buggs Island. It would be unfair to charge all of this storage to the users of power that result from a 140-foot dam at Buggs Island or to charge this amount against the taxpayers.

Q. Mr. Hamilton, throughout your testimony thus far you have used the terms "feasible" and "non-feasible." As applied to projects of this character what does that mean?

A. Feasibility is universally understood by utility men in determining whether a project should proceed

by making a comparison of such projects and all other sources from which power could be secured. If it is found that a proposed project can provide the same amount of power capacity and energy at less cost than it could be secured from other sources, the [1002] project is then considered feasible.

Q. In other words, do I understand you correctly to say that if, for example, the excess of cost of steam power over hydro is $404,000, the project is feasible because the consumers will have to pay $404,000 less for hydro than for steam?

A. That is correct.

Q. But if you take into consideration the downstream benefits and the difference is reduced to a minus figure, then what does it mean in terms of what the consumers will have to pay?

A. Any development which carries with it an excess of cost over what you could secure power for elsewhere can only mean one thing, that the public would have to pay the excess cost and the project is then called "infeasible."

Q. Mr. Hamilton, with the downstream benefits assessed as you estimate, namely $690,000, what would be the cost of power to the applicant per kilowatt hour?

A. According to Exhibit 15 the total annual cost is given at $2,829,000. If we add the amount of the downstream benefits in the sum of $690,000 the annual cost will be $3,519,000, and the cost per kilowatt hour will be 12 mills.

Since the cost of firm steam power appearing on Exhibit 15 is 8.6 mills per kilowatt hour, the hydro project is uneconomical.

* * * * *

[1004] Q. Mr. Hamilton, I believe there was one question I asked you which was not clear. I asked you to comment on Exhibit 52 consisting of three sheets, and you mistook my question to ask you to comment on Sheet 1 of the exhibit. Will you please comment on sheets 2 and 3 of Exhibit 52 so that we may have a complete answer to my question?

A. I did not answer your question completely because I did not make any reference to sheet 2 and sheet 3. Sheet 2 is a letter from a Lieutenant Colonel of the Corps of Engineers. The letter is in transmittal of costs that appear on Exhibit 52, sheet 3, and also set out benefit of $735,000, which appears in sheet 1.

* * * * *

[1085] Cross-examination by Mr. MOORE:

* * * * *

Q. Would you kindly refer us to any part of the transcript on which you relied in respect of your statement about the operation of the plant at full capacity 91,000 kilowatts 16 hours a day, five days a week? Have you that reference to which you referred?

A. The reference that I have is that the plant would be operated 16 hours a day, and that the dependable capacity was [1086] 91,000 kilowatts. Now, under the limitation under which this plant would be built, it is

very difficult, if not impractical, to vary the output of the dependable capacity from the 91,000 second-feet. Therefore, as a capacity plant in my opinion it doesn't meet the requirements of a capacity plant.

Q. Are we to understand you have assumed it would be operating at the 91,000 16 hours a day?

A. It very nearly has to operate at that for the reason that the government has placed a limitation in there wherein to increase the capacity you have to increase at the rate of 180 cubic feet per second per minute. If you were running 90,000 kilowatts and cut down to 60,000 kilowatts, you would then have reduced the flow of water by some 6,000 second-feet. Now, to get back to 6,000 second-feet, it would take pretty nearly 30 minutes; so that plant, as a capacity plant, would run into extreme difficulties if they tried to vary the water as it should be varied on a capacity plant.

Q. So those are the reasons why you have assumed that substantially it would have to operate 16 hours at 91,000 kilowatts?

A. No, that was only one of the reasons. One of the other reasons was that they claim to operate the plant in December to take care of the peaks. That would mean you would be spending about $26,000,000 to operate a plant one per cent of the time, where you could go and spend $13,000,000 less and [1087] operate your plant almost 24 hours a day.

Q. Did you hear, or did you read, Mr. Cary's testimony appearing on pages 451 and 453 of the transcript, that the 91,000 kw. would be needed for not

more than about one hour in the December daily peaks?

A. Yes, sir, and that was the reason I just gave you just now, but I would not expect that a good operating company would expend $26,000,000 for one hour's operation when they could go and spend $13,000,000 and get a plant that would do far more, or they could spend $26,000,000 and get a plant of 180,000 kilowatts capacity, which would enable them to take care of their growing loads. My point is, when you buy a capacity plant you want a capacity plant, it has got to operate on peaks and it has got to operate not only on your December peaks, but the January peaks. The January peaks follow the December peaks, and as a rule, according to the report of the nation, those peaks in January are as high as they are in December. Furthermore, when you have a capacity plant, you have to have a dependable capacity plant, and that means that that plant has to be available to run in the periods when you want to take your large units down.

* * * * *

[1112] Q. Will you turn, now, to page 984, and 985 of your transcript, where, in answer to the question, "Do you consider the Roanoke Rapids a desirable hydro-electric project without Buggs Island?" have you considered the requirements for stream flow of the Roanoke Rapids project when operated on the Virginia Electric and Power Company's load as a purely peak load plant?

A. It seems to me your question does not embody the meaning of "peak load."

* * * * *

Q. I will hand you the transcript covering Mr. Cary's testimony, page 147, and also the transcript covering his testimony at pages 451 and 453. I there call your attention to his description as to how the plant would be operated. If you will just read that answer on page 147, first.

* * * * *

[1113] By Mr. MOORE:

Q. On page 451 of the transcript, Mr. Cary testified:

> The full 91,000 kilowatts of capacity would only be needed during those short evening peaks that occur in the winter months, the latter part of November, December and January.

Then again on page 453 he testified:

> During the extreme low flow periods, the full 91,000 kilowatts will not be required at all. As I stated, the full 91,000 kilowatts will only be required during the extreme peak load periods of the year.

How long will you require it during those low flow periods?

A. I answered that a little while ago about one hour per day at the most, but not all of it every day.

* * * * *

By Mr. MOORE:

Q. Have you considered the requirements for stream flow of the Roanoke Rapids project when operated on

the Virginia Electric and Power Company's load as the peak [1114] load plant, and I there referred the witness to the precise testimony of Mr. Cary showing just how the plant would be operated. I now ask you whether you have considered the requirements for stream flow of the Roanoke Rapids plant when operated on the particular load of Virginia Electric and Power Company as a peak load plant, as Mr. Cary has described it.

A. I did, and I went a little further.

* * * * * *

[1115] Q. Now, I ask you, in giving that answer, what consideration, what weight did you give to Mr. Cary's description as to just how the plant would be operated on Virginia Electric and Power Company's peak load?

CHIEF PRESIDING EXAMINER. Did you consider Mr. Cary's description as pointed out by counsel?

The WITNESS. Yes; I did.

CHIEF PRESIDING EXAMINER. Did you give any weight to it?

The WITNESS. Yes.

By Mr. MOORE:

Q. What weight?

A. In two cases. One, he said the plant would operate 16 hours a day and the other set forth that the plant would be operated one hour, as you just read, one hour peaks, and only in December.

[1116] I then assumed they would probably need the plant over December, that they would have to run it. I was very generous. I figured his peak might

be four hours and they would run it for as much as 80 hours a week. Now, 80 hours is just less than one percent of 8,760 hours. My reason for arriving at that conclusion was that it did not look to me like good engineering sense or good business sense to spend $26,000,000 to operate a few hours in December when, for that same amount, they could get a plant which would operate 16 hours a day or 24 hours a day over December and would operate at less money.

Q. Then you did not accept Mr. Cary's description as to how the plant would be operated as a basis for your testimony, did you?

* * * * * *

[1117] The WITNESS. I don't know what you are talking about.

By Mr. MOORE:

Q. Did you adopt it?

A. No; I did not.

Q. You did not adopt it, did you?

A. No. It is impracticable and it couldn't be operated that way, according to the testimony presented here.

Q. That answers the question. Are we to infer then from your testimony that you intended to represent that when operated as a peak load plant, as Mr. Cary described it, that 18,050 second-feet operated for 16 hours per day would be required to take care of the peak loads on the particular system of Virginia Electric and Power Company?

A. We are talking about a dependable capacity plant for which the applicant desires to spend 26 mil-

lions of dollars. Therefore, he has to operate the plant a good many hours of the day and throughout the year. Consequently, I figure that in order for the investment to work out it would have to operate more hours.

Now, I referred to Mr. Uhl's question of when the plant [1118] was to be operated. He indicated on his sheets and in his reports—and I will read those hours to you; in June 300 hours; in July 350; in August 337; September 325; October 350; November 350; December 400; January 375; February 325; March 325; April 325; May 300; December 415 in '54; in December '55, 415; in December '56, 415. And in analyzing the curves of the loads that he had before him in that report I found that the minimum hours over which a hydro of 91,000 kilowatts would operate to utilize the investment was 100 hours in June, 200 in July, 135 in August, September 235, October 200, November 100, December 100, January 150, February 175, March 175, April 250, May 250, December 75 for '54; December '55, 100, December '56, 75.

There is no place that I can see where Charles T. Main could set out that the plant was going to be operated just a few hours in December.

Q. Do you understand those figures you are referring to there related to a critical year or the average year?

A. Well, when you are talking about a capacity plant you have to talk about the critical year. When you buy capacity you have got to buy it for the worst condition because you only have from 10 to 15 percent

of excess capacity; so if you are talking about dependable capacity that is one thing. If you are talking about capacity you have when it rains, that is another.

[1119] Q. Did you understand from your interpretation of the Charles T. Main Exhibit number 29, as to the figures you just read, that that report was there dealing with the average year or the critical year? The answer to that is yes or no. Which did you?

* * * * *

The WITNESS. This is dealing with the different years, the years as they come up. He is dealing with June 1955. I will start at the beginning. He is dealing with June 1953 and he is fitting the load curves into it. He does the same with '53. They are all future years.

By Mr. MOORE:

Q. Are they average years or critical years that he is using, do you know?

A. What do you mean by average years? He has shown the expected loads.

Q. I mean average flow years, that is what I am talking about.

A. Well, he is using 96,000 kilowatts in December of '53. Certainly that can't be a low year. He is using the December kilowatts in '54 of 96,000. Certainly that can't be [1120] a low flow year. He is using, in February of '54, 96,000 kilowatts; that can't be a low year.

* * * * *

[1129] Q. Mr. Hamilton, will you now turn to the chart attached to the Charles T. Main report, Exhibit

29, and find the chart entitled, "Estimated load duration curve, VEPCO System, net load, June 1953."

A. I have that.

Q. That is the chart with which you were dealing in your testimony before the lunch adjournment, was it not?

A. That is correct. That is one of the charts.

Q. That was the first one that you referred to?

A. Yes.

Q. Now, when you referred to the June 1953, chart, which you have just stated, in the Charles T. Main report, Exhibit 29, [1130] which you have before you, during the forenoon session you read off a time of 300 hours for the month of June.

A. That is right.

Q. Does not this time, 300 hours, as there shown, show the maximum number of hours during the month that some of the 157,000 kw. load must be carried, rather than the total number of hours that some of the peak load of 91,000 kw. must be carried by the Roanoke Rapids plant?

* * * * *

The WITNESS. Yes; it does.

By Mr. MOORE:

Q. Is not the same situation true for the charts for all the other months for which you gave these figures from this report this morning?

A. No.

Q. Doesn't that same condition prevail?

[1131] A. No.

Q. What is the difference?

A. Because in this month it only shows an average of 33,000 kilowatts. In the month of October, '55, it shows 96,000; in November 1953, it shows 96,000; of 1953, December it shows 96,000; of January 1954, it shows 96,000; of February 1954, it shows 96,000; of March 1954, it shows 96,000; of April 1954, it shows 63,500.

Q. Now, with those exceptions, did the same condition prevail as with respect to the month of June?

A. I don't understand the exception.

Q. Those differences, then, if you want to call it that, except for those differences.

A. It shows that 96,000 kilowatts was contemplated by Charles T. Main to be used in those exceptions in order to carry the load.

Q. I say, now, except for those exceptions the same condition prevails in these other months as in the case of June 1953, as I understood you; is that right?

A. Except that the 96,000 would be carried throughout all hours, as indicated on the report, as indicated on the sheet.

Q. If the 91,000 kw. peak is carried on the top of the load, does not that first chart to which you have just been referring, the June 1953, chart, show that the full [1132] capacity of the plant would be required for only a very short time indicated by the width of the chart at its very peak?

A. It indicates that this plant is not the kind of a plant that can be operated as a peaking plant under variable load conditions.

* * * * *

By Mr. MOORE:

Q. Well, does it not show that the full capacity would be required for only a short period of time, as indicated by the width of the chart up there at the peak?

A. If I analyze it the same way it has been analyzed by Charles T. Main, I figure that it could be operated for a hundred hours.

Q. For the month of June?

A. For the month of June.

Q. 1953?

A. Right.

Q. Mr. Hamilton, if the Roanoke Rapids plant is to be used as a peak load plant, will not this peak part of the curve show the number of hours that full capacity is required and that for all other hours a much reduced capacity will be required from the Roanoke Rapids plant?

A. While it shows that, that is just theorizing. Here you have a plant that is supposed to take the peaks. If it [1133] doesn't take the peaks your load is not satisfied. If we back off with peaking on this plant, then we are unable to have the plant come in again to take the swing, because the restrictions are such that the peaking plant cannot come back on again only at the rate of about a thousand kilowatts a minute.

Q. Well, so far as the showing on that chart is concerned, it certainly shows that the full capacity is not required for all other hours, does it not?

A. Yes; the chart shows that, but that is without meaning.

Q. You just don't feel that means anything?

A. It doesn't mean anything, as far as a dependable capacity hydro plant is concerned.

* * * * * *

By Mr. Moore:

Q. Will you now turn over to a chart in the Charles T. Main report entitled, "Integrated Kw.-h. hours versus Kw. for top 200 Kw. of load duration curve, dated June 1953." Do you find that?

A. Yes.

Q. Turning now to that chart, will you tell us how many [1134] hours for the month of June 1953, that chart shows would be in the 91,000 Kw. peak of the June 1953, load? Just read off the chart how many kilowatt hours for that month would be included in the peak.

* * * * *

A. Eleven.

* * * * *

[1135] By Mr. Moore:

Q. Does it not appear from that chart that the answer to my question is approximately five million? Do you disagree with that? Or, 5,000 megawatt-hours.

A. If you put the 90,000 kilowatt plant right on top of the peak, then it would be the difference between 612 and 90, or down to the point marked 520, which would come up to five. But the plant can't

operate that way. It is just impossible for the plant to operate that way.

* * * * *

[1137] Q. My question, Mr. Hamilton, was whether or not that chart showed how many kilowatt-hours for the month of June would be involved there in a 91,000 peak for the month of June 1953. Now, I ask you, does not that chart show that so far as the chart is concerned, the answer to that question is approximately five million?

A. Yes.

* * * * *

CHIEF PRESIDING EXAMINER. Mr. Hamilton, do you desire to make an explanation of that answer?

The WITNESS. Yes, because my answer would be misinterpreted.

CHIEF PRESIDING EXAMINER. Very well, sir, you may do so.

The WITNESS. For the reason that when you try to operate 91,000 kilowatts on a peak that varies, the plant you are figuring on operating in such a manner would encounter the restrictions of the United States Army, the U. S. Engineers, as to downstream flow and the plant just won't deliver in that [1138] manner.

By Mr. MOORE:

Q. Are the kilowatt-hours indicated on that chart anywhere near as many as called for in your hypothetical study shown on your exhibit No. 51, for 16 hours' operation?

* * * * *

The WITNESS. These kilowatt-hours are much lower than as shown on that exhibit.

By Mr. MOORE:

Q. That is, on the chart?

[1139] A. Yes.

Q. Then they are as shown on your Exhibit 51?

A. That's right, and they are also much lower than as shown on the Charles T. Main report.

Q. Yes. Mr. Hamilton, could you tell us what is the load factor that is assumed for the Buggs Island plant, if it is designed and constructed as proposed in Exhibit 10? That is, the Definite Project Report.

* * * * *

A. Dependable firm capacity on Buggs Island is about 23 percent.

Q. What were the factors you used there?

[1140] A. I took 108,000 kilowatt-hours and multiplied by——

Q. By 108,000 kilowatts, you mean?

A. For rapidity I just used 100,000 and multiplied by 8,760, then divided 876 million into 200 million.

Q. You were using 200 million as the estimated number of firm kilowatt-hours, were you not?

A. That is right.

Q. Now, if you used the real fact which the evidence shows to be the fact, 108,000 kilowatts, would not the load factor be approximately 21 percent?

A. I can multiply that out, if you wish.

Q. I wish you would.

* * * * *

[1141] The WITNESS. It would be a little over 21 percent.

By Mr. MOORE:

Q. What is the load factor in the Roanoke Rapids project 2009, if that is designed and constructed as proposed, so far as dependable capacity is concerned?

A. Why do you take the 91?

Q. I said the project was 2009. Woudn't you take the 91,000 kw. and apply that to the firm kilowatt-hours?

A. You have to take 96,000.

Q. That includes the downstream plant also, does it not?

A. Yes, but we are talking about improvements, and we have to provide water for the downstream plant as well.

Q. The evidence shows that there is the downstream plant now of 6,000 kilowatts, and that the application here is for authority to build the 91,000 kw. plant. I simply want you to give us what will be the load factor, as you figure it, on the plant as proposed.

* * * * *

[1142] The WITNESS. Twenty-six.

By Mr. MOORE:

Q. Five points higher, is it not, than Buggs Island? As we understand it, you do consider the Buggs Island project a desirable hydro-electric project, do you not?

A. Yes, I think Buggs Island is a desirable hydro-electric project.

Q. Do you see any relationship between those two?

A. No.

Q. Those two load factors?

A. No.

Q. You don't think there is any connection between those two?

A. No.

Q. As to the desirability of the two projects?

A. No, sir.

* * * * *

[1143] Q. Now, will you look at line 20 of your explanation of the chart there referred to, where you stated, "You will note, for example, instead of 9,192 c. f. s., that in 1912 we had one month of only 2,200 c. f. s., in August——" and so forth. "In August 1914, we had one month with 2,980; in August, 2,370; in September, 1,480."

Are we to understand from that testimony that you intended to state that if we carry the peak loads of Virginia Electric and Power Company's system, that those flows of 2,200 c. f. s., and so forth, are insufficient, or do you wish to represent that in your judgment they are insufficient only to carry the block loads shown on your analysis for 16 hours' operation?

A. No, I have run circles around all those months in which we were short 9,192 c. f. s. Now, the number is so great that there is a very serious question as to whether the plant should be built for 9,192 second-feet operation, to serve for 50 or more years in the future, to serve a load curve that we try to predict now, to serve a water flow we try to predict

now, to figure that you can vary the peaking of the plant as you see fit, and if you can discharge either 1,000 second-feet [1144] or 18,000 second-feet downstream as you see fit, and if you are not modified on the limitation of the change of 1,000 kilowatts minimum to some much higher figure.

Once any change—or, if all these if's are not answered according to the way it has been testified here by the applicant, then you do not have a dependable capacity plant.

I am testifying to the fact that you haven't a dependable capacity plant unless you were to control many of the features in that "if", including the release of storage from the upstream reservoir.

Q. Well, that testimony I have just called your attention to as to those low stream flows was based, as I understand it, on your assumption that you used this forenoon, that the Roanoke Rapids plant, as proposed by the applicant to be economical would have to be operated at substantially the 91,000 kw. for 16 hours a day, was it not?

A. Yes, from an economical point of view, and from a practical point of view, it should be capable of operating 16 hours a day.

Q. And you have assumed that in your reference to these low stream flows, did you not?

A. Well, I assumed that if you tried to operate for 16 hours, and when you try to operate for even eight hours, there is a serious deficiency of water unless you have storage.

* * * * *

[1145] By Mr. MOORE:

Q. Mr. Hamilton, do you know any large utility system peak load that requires the block operation? I am now speaking about this 91,000 for 16 hours a day, such as you have assumed in your Exhibit No. 51. Could you give us a reference to any large utility system that operates with a block load the way you have assumed in that exhibit, on a peak?

A. Well, I can mention Bonneville, Grand Coulee, for example. I could mention the Seattle projects, feeding into Seattle.

Q. You think they operate on that same basis?

A. Not exactly on the same basis, but they operate with [1146] load factors approaching up in the nineties.

Q. Do you regard Bonneville as a large peak load system?

A. By a large peak load system, I presume you mean one with a low load factor?

Q. Yes.

A. Bonneville has not a low load factor, but here in this place we are predicting or trying to predict what the load factor is going to be for the next 50 years—we can't do it.

Q. Mr. Hamilton, in the light of Mr. Cary's testimony, to which I called your attention this morning, particularly a statement on page 451 and 453 of the transcript to the effect that he would need the full 91,000 capacity on his system load for periods of approximately one hour per day during the peak load

period of December—will you just refer to that testimony and get that sharply in your mind?

* * * * *

A. I don't have that [handing transcript to the witness].

CHIEF PRESIDING EXAMINER. Do you have it now, Mr. Hamilton?

The WITNESS. Yes, I have it now.

By Mr. MOORE:

Q. Just take a moment and get that clear in your mind.

A. Yes, I have that.

Q. Now, I call your attention to your testimony on page 988 of the transcript where you state, "In my opinion——

* * * * *

[1147] Q. Where you state, "In my opinion," line 25, "In my opinion, the 91,000 kw. plant, without Buggs Island, would not have sufficient dependable capacity for operating through 16 hours per day to warrant its construction." Do you see that?

A. Yes.

Q. Now, I ask you, do you wish to represent it is your judgment, in the light of that testimony, that the Roanoke Project would not be dependable for 91,000 kw. on the system load of Virginia Electric and Power Company? We are looking at that only, now, so as to warrant its construction.

A. I have this testimony before me. I have the Charles T. Main report before me on which I presumed the project would be built, and Charles T.

Main, in their report, does not show that the plant is only going to be operated one hour in December, January, and February.

Q. In other words, for this purpose you disregarded Mr. Cary's testimony?

A. No; I took his testimony into consideration, I took Charles T. Main's testimony into consideration, I took the practicability of the project into consideration as to its ability to operate on peaks. This isn't a peaking plant. It is so limited that it cannot be operated to just run up for an hour, then come down and then come up again.

Q. So that as you stated this morning, you for this [1148] purpose simply do not adopt Mr. Cary's method?

A. That isn't what I said at all.

* * * * *

Q. Mr. Hamilton, in your answer on page 990, will you look at that, starting with line 19?

A. Yes, sir.

Q. You there referred to preferred customers, if you will notice?

A. Yes.

Q. Are we to infer from your testimony there that it is your judgment that the flow releases from Buggs Island may be at a uniform rate around the clock, is that what you meant to represent?

A. No, sir. I meant that the preferred customers would have to have energy around the clock and possibly some other customers would have to have energy around the clock, so that the amount of energy left

for peaking would be reduced by the amount of energy such customers took.

Q. You were there not considering the pondage at Roanoke Rapids, were you?

[1149] A. The pondage at Roanoke Rapids has to be released in the form of 24,000 second-feet per day, in some form or other. If we have a load that is in excess of the pondage in Roanoke Rapids, then the water that could pass in excess of the pondage would be waste water and could not be held for peaking purposes.

* * * * * *

Q. Will you turn now to pages 157 and 158 of the transcript in which Mr. Cary testified and said:

* * * * * *

> [1150] If the output of Buggs Island should be sold to other utility systems, private, R. E. A., or municipal, the release of water from Buggs Island will undoubtedly follow the same general pattern of operation as if we had purchased the power, and the release of water would be such as to fit in with the planned operation of the Roanoke Rapids project. Any normal deviation from such planned usage can be readily taken care of by the use of the storage available at the Roanoke Rapids project.

Now, I ask you, in connection with that testimony, have you considered the pondage available at the Roanoke Rapids project when built to elevation 132 in your statement that a contract with the government would be necessary to assure the operation of Roanoke Rapids, as testified to by Mr. Cary?

A. I have taken into consideration that pondage, but we don't know what the load is going to be of preferred customers of Saturdays, Sundays, and holidays. We don't know what the loads of other customers are going to be during those periods, so I don't see how anyone can make the statement that Mr. Cary has made in there.

CHIEF PRESIDING EXAMINER. You do not agree with Mr. Cary's statement, Mr. Hamilton?

The WITNESS. No; because we don't know what the load of the preferred customers is going to be.

* * * * *

[1151] By Mr. MOORE:

Q. Mr. Hamilton, will you turn to page 991 for a moment, with respect to a question on line 4. The question was:

> In your opinion, would it be a prudent investment on the part of the applicant to proceed with the construction of Roanoke Rapids without making provision for enjoying and paying for the benefits that would result from the construction and operation of the Buggs Island project.

You will notice your answer there was, "It would not."

Will you now state what provision, other than providing for the normal construction of the Roanoke Rapids project, would be necessary to enjoy the benefits there referred to?

A. What construction would be necessary?

Q. Yes; what additional provisions would be needed in order to enjoy those benefits which would not be otherwise incurred?

[1152] A. The benefits that accrue to Roanoke Rapids result from a storage which is 100 times greater than the storage at Roanoke Rapids. Therefore, to get the same result, they should have approximately the same storage.

Q. Mr. Hamilton, will you turn to page 992, where you discuss the costs of hydro and steam referred to in Exhibit 15? Do you see that?

A. Yes, sir; I have it.

Q. Do you not recognize that Exhibit 15 does take into account the difference in cost of $13,157,000 in arriving at the net benefits of the construction of the hydro plant?

Doesn't that exhibit specifically take that difference into account?

A. It does, and it does not.

Q. Just explain.

A. Well, if the steam plant is acquired, the steam plant can be run as base load, which is the customary practice, and instead of operating on a cost of 5.9 mills, as occurred with fuel in 1947 at your 161,000 kw. plant at Norfolk, the steam could be produced at a cost of about 3.76 mills. Consequently, the exhibit as is does not represent all of the advantages that would accrue to operating a steam plant which would operate at somewhat less than 12,000 B. t. u.'s per kilowatt hour, while the B. t. u.'s per kilowatt hour in 1947 for the steam plant were 16,402.

[1153] Q. Mr. Hamilton, on that same page where you refer to the greater risk in investment, that is, the hydro, the greater must be the cost of the money with which the investment is made. Is it not true that this risk in investment is a measure of the return allowed by public utility commissions for net return on investment to a utility company. Isn't that so?

A. No; this is a different kind of risk.

Q. What is the difference?

A. Well, this is judgment as to whether they build the project to get 91,000 kilowatts by hydro, if they get it from steam, which project would involve the least risk to the company.

Q. Mr. Hamilton, what is your basis for assuming that the figure of $261,000 is a proper minimum charge to the applicant for the benefits to be charged the applicant for the cost to the United States in the operation of the Buggs Island storage?

A. I didn't say that.

* * * * *

[1154] By Mr. MOORE:

Q. Let me call your attention to the testimony at the bottom of page 992. You say, "The fact that the benefits may fall between $261,000, as stated by the applicant, and the benefits to the United States, which may amount to a million dollars, must, of course, enter into any calculation of cost." You say you did not assume that figure of $261,000 there?

A. I took that figure from the testimony, and here was a question of considering whether we should add a certain amount to the expenses. Now, what shall

that be? Shall it be two hundred and sixty-one, or shall it be a million dollars, or shall it be some figure between there so as to arrive at the question of prudent investment.

Q. Do you contend that you did not intend in that statement to give a minimum of $261,000, with a maximum of a million [1155] dollars?

A. No; I didn't contend that two hundred and sixty-one would be the minimum.

Q. Were you not familiar, from your reading of the transcript, that Mr. Cary had stated, as he calculated the matter, the 261,000, as shown on his Exhibit 28—— * * * was a maximum figure. Do you recall that?

* * * * *

Q. Don't you recall that?

A. Yes, I do.

Q. Did you have that in mind when you made that statement, what I have shown you in the transcript?

A. No.

* * * * *

Q. Mr. Hamilton, on a utility load of the size of the [1156] Virginia Electric and Power Company, is it your view that it is not a prudent investment to have some capacity which can be used on the peak of the load for only a short period of time, when the percentage of such capacity is now over 15 or 20 per cent of the total system capacity?

A. If you are going to have dependable capacity, it has got to be dependable; it has got to be there whenever you want it, and it has got to be there for emer-

gency. You cannot have it there just to operate one hour. While it is on there for one hour, maybe your largest unit will drop out.

Q. Won't you just answer my question and then give any further explanation.

My question was: Is it your view that you are presenting here that it will not be a prudent investment for a utility load of the size of Virginia Electric and Power Company to have some capacity which can be used on the peak of the load, for only a short period of time, when the percentage of such capacity is not over 15 or 20 per cent of the total system capacity?

* * * * *

[1157] The WITNESS. The load has to be taken care of. Therefore, provision has to be made to take care of this peak. The usual way to take care of the peak is to operate the most inefficient units of the power plant on the peak and put in the newer units as base load. But here we are talking about a plant that is not suited to peak operation on account of the fact that you cannot vary the load on it. It is limited by the U. S. Engineers and if anything happens in the system you are unable to have it fulfill its full rating. So when a utility company is going to acquire dependable capacity it has to be dependable capacity available for use at any and all times, not only on the peak, but at any other time something may happen on the system.

By Mr. MOORE:

Q. Is any peak capacity plant, such as Buggs Island, available for load 100 per cent of the time?

[1158] A. Buggs Island is not available 100 per cent of the time.

Q. Mr. Hamilton, will you turn to page 993 of the transcript, line 14, where you are referring to the feasibility of the project, and you are stating that it would certainly be less without positive control of storage and since the percentage of feasibility is very small, you there state, being 1.143, according to Exhibit 15, and 1.115, according to Exhibit 23, you point out that the last degree of feasibility would probably result in rendering the project infeasible. If you will also look at your answer on page 994, to the effect that the lessening in feasibility would probably result in rendering the project non-feasible.

I now ask you, do you mean by these statements to represent that it is your judgment that the lack of a contract with the government for the control of the release of water at Buggs Island would make it impossible for the applicant or for this Commission to determine the benefits that would accrue in flow regulated at Roanoke Rapids, due to the operation of the Buggs Island reservoir.

* * * * *

[1159] The WITNESS. No; that is the answer.

By Mr. MOORE:

Q. Have you an explanation of that?

A. Yes, sir. When you are talking about——

* * * * *

[1160] The WITNESS. If we are going to invest $26,000,000; we ought to have some assurance that

we are going to have stored water turned over to us in such a way that we can make use of our investment. If we don't do that, we run up against the question of whether that is a good business to be undertaken.

We cannot anticipate how the storage at Buggs Island is going to be used. It may be held for different kinds of load. It might be held for applying load for testing airplanes. When I was with the Interior they wanted 150,000 kilowatts. They wanted that load on at nights. They were willing to do their laboratory work in the daytime and take the load at night. So that if the party downstream doesn't take the precaution to see that he is going to get water, I don't see how we can make up any substantial statement on which the project can be financed, unless he is sure of his water. That is all.

By Mr. MOORE:

Q. In giving that answer, have you in mind the requirements in regard to furnishing power to the preference customers, the cooperatives, and municipals?

A. Yes.

Q. Then we do understand correctly that you contend the lack of a contract with the Secretary of the Interior regulating the flow at Buggs Island would prevent the applicant from deriving a capacity output upon which the ratio of feasibility shown on Exhibit 15—that is Mr. Cary's Exhibit—was **[1161]** computed?

A. Yes——

* * * * *

Q. Do you intend to represent that in your judgment the operations of the Buggs Island Reservoir may be such that it would be a detriment to the operation of the Roanoke Rapids plant?

A. No.

* * * * *

Q. What was the point of your reference to this night operation?

A. Well, we don't know now how Buggs Island is going to be operated. The Secretary of the Interior will do everything he can to see that no water is wasted, but neither he nor anyone else can tell what demands will be placed on Buggs Island for that water.

Q. If the situation were such that a detriment might [1162] reasonably be expected, would there be any basis for downstream benefit charges being required, in your judgment?

A. If there are no benefits—the government should not ask for benefits from the Buggs Island storage unless they actually render benefits to the downstream project.

Q. Then in that case, I assume, there wouldn't be any basis for downstream benefits being charged, would there?

A. There might be in part, and there might not be. It depends on the extent that the storage is used when its use would not be to the advantage of the Roanoke project.

Q. Mr. Hamilton, will you turn to page 994 of your testimony where you mentioned certain dangers

due to the operation of the proposed project as affecting navigation, recreational facilities, and fish life. Do you see that?

A. Yes.

Q. Is it not true that the Interior Department and the United States Army Engineers specify certain requirements which they recommend for the license which, when followed by the applicant, would take care of the dangers that you are inferring and the allowable variations in stream flow?

A. No; they might not for the coming 50 years.

Q. You don't think their recommendations would prove to be adequate?

A. Well, one of the recommendations they make is that they require to provide so that they have the right to build a [1163] lock through the dam. Well, if they build a lock through the dam, that means they are going to have navigation below the dam. If they have navigation below the dam, you certainly can not fluctuate from 1,000 to 18,000 second-feet. And if it does result that fish are being impounded in the pools and dying there, or being taken by fishermen who would rather get them that way than fish for them, or if there are some lives lost through the change in the flow of water, there would be a fire built up under the operators of the project, so that they would have to operate in a different manner.

Q. Mr. Hamilton, I believe you said you heard all the testimony, or you have read that which you did not hear.

A. Yes, sir.

Q. On page 996, line 14, you state:

> I have already testified that the Roanoke Rapids project of itself is without dependable capacity to operate 91,000 kilowatts at 16 hours, for five days a week.

A. Yes.

Q. Now, is it not true that under the peak load operation, as proposed by the applicant, the dependable capacity is not tied in to 16 hours' operation at 91,000 kilowatts, and don't you know that that is so?

* * * * *

[1164] By Mr. MOORE:

Q. Referring to the question I just mentioned, without repeating the whole question, is it not true that under peak load conditions proposed by the company in this proceeding, the dependable capacity is not tied into 16 hours' operation and 91,000 kilowatts?

A. Mr. Cary testified that. My answer to that is if you are only going to use the peak power for one hour a day—I know he didn't say how many days, but let's say five days a week for 20 days a month—and that is going to be the value of the plant, then we are only using the investment over something like one per cent of the time. Therefore, I conclude it is not a good investment.

Q. Mr. Hamilton, is it true that the peak load on the systems of the REA cooperatives and municipals—and I am [1165] now here speaking about the Buggs Island project—would occur at about the same season of the year as the peak load of Virginia Electric and Power Company, or do you know that?

The WITNESS. I don't know it.

By Mr. MOORE:

Q. Have you any opinion on that, based on your experience?

A. Yes. Sometimes loads vary very materially. I am going out on a job now where they are putting in space heating. Space heating has resulted in entirely swinging the condition of the peak load. We would like to get away from it so that the load condition—this outfit is far different from what was anticipated, and far different from the general area.

* * * * *

[1166] Q. Mr. Hamilton, on page 997 of the transcript, will you now turn to line 6. You there state:

> However, the storage may not be released as desired at the very time it is needed by the applicant.

If that were the method adopted by the government for the operation of the Buggs Island plant so that the storage is not released at the times when the applicant would receive downstream benefits from the use of such storage, would it not follow that the applicant could not afterward be charged for any such benefits?

A. If the applicant didn't get any benefits from the storage, then he should not be charged for the storage.

Q. Will you turn now to your last exhibit No. 52, sheet 1.

A. Yes, sir.

Q. And your testimony in that connection on page 999 of the transcript.

A. Yes, sir.

[1167] Q. It appears from your exhibit and your testimony at the point I have indicated that in your amount allocated to power on that exhibit, $46,460,000 is not part of this cost chargeable against dead storage in the reservoir which is necessary to develop head at Buggs Island and not necessary as the reservoir is to be used just to increase the regulated flow in the river. Isn't a part of that amount properly chargeable to what you engineers call "dead storage"?

A. The only way you can get a sufficient volume for storing water is by increasing, or by bringing the dam up to a certain elevation.

* * * * *

Mr. MOORE. I am talking about the power in Buggs Island. I am asking you whether or not there should not be allocated to power the costs chargeable to dead storage in that Buggs Island Reservoir.

The WITNESS. No.

By Mr. MOORE:

[1168] Q. Why not?

A. Because the dam would have to be built 144 feet high. It would require not only a space for flood, but in order to get benefits for the project to be built, most of the benefits for the project would be paid by power. Therefore, there is no place else to make charges for the other costs except to power.

* * * * *

Q. Do you question there are those four major parts of the cost of that project?

A. You can divide the physical cost——

* * * * *

[1169] The WITNESS. Yes, I do.

* * * * *

Q. Why do you question it?

A. Because when we divide it up into four parts we are dealing with the physical fact. When we divide it up between power and other uses, we are dealing with the economic facts.

Q. Physically there are those four major component parts, are there not?

A. Yes, sir.

Q. In computing the amount you have allocated to power, you have deducted only the flood storage and the powerplant equipment, have you not?

A. That is right.

Q. Mr. Hamilton, under your treatment of this matter, should not the total reservoir costs allocated to power of $1,388,000, be divided so that a proper proportion is allocated to the development of the head at Buggs Island before any division is made for allocation to the downstream projects?

A. I gave that considerable thought and I thought of two things. We build a dam almost twice as high as what we need [1170] for power. In emergencies and low water we may be very glad to use the dead storage and hold the dead storage. That is particularly true if we operate the downstream plants, if we wish to benefit them.

Q. Mr. Hamilton, is not dead storage a well-recognized conception that engineers experienced in hydraulic projects deal with constantly?

A. Yes, they do.

Q. And isn't it treated frequently and normally as a separate item? Do you question that?

A. It is set up as a separate item in acre-feet of storage, but it is not set up in allocation of costs.

Q. But under your view, as you have presented it, in determining the amount that should be apportioned to Roanoke Rapids, should not the cost of storage be divided between Buggs Island, Gaston, and Roanoke Rapids in proportion to the head at the three projects, at least on that basis, as a starting point?

A. Yes, I think so.

Q. Now, if this allocation were properly followed, would not the apportionment to Roanoke Rapids, even on the basis on which you have set it up, be materially reduced?

A. It would then be reduced to a little over $400,000 instead of $672,000.

* * * * * *

[1171] The WITNESS. Yes.

* * * * * *

By Mr. MOORE:

Q. Is it not true, Mr. Hamilton, that the cost of $1,380,000 is apportioned into an element for creating head at Buggs Island, as well as storage benefits to Buggs Island and downstream construction projects? It is certainly clearly apportionable, is it not?

A. It is——

[1172] Q. But you didn't do that, did you?

A. No; I don't think it belongs in my calculation.

* * * * *

[1173] Q. Are you in a position to state that there was any additional amount of cost included for the construction of the Buggs Island reservoir because of anticipated storage benefits that might accrue to downstream plants, that would not have been included if those plants had not been considered at all? Can you say there was any additional amount included on that account?

A. Not from the physical point of view, but from the benefit point of view, yes.

Q. Any amount in cost, now, is what I am talking about.

[1174] A. In construction costs?

Q. That is right.

A. No.

Q. Mr. Hamilton, do you mean to state that the charge from apportioning Buggs Island storage cost would or should, in any case, exceed whatever is the actual benefit to Roanoke Rapids?

* * * * *

The WITNESS. Yes, I meant to say that.

Mr. MOORE. All right.

By Mr. MOORE:

Q. Would you state or contend that a charge to a project which is economically feasible without the storage benefit could properly be so great as to make the project infeasible and thus make the benefit become a loss?

* * * * *

The WITNESS. No; because his assumption——

* * * * * *

The WITNESS. Because the feasibility of Roanoke Rapids [1175] without Buggs Island is not a fact. It is only feasible if it can enjoy the storage from Buggs Island.

By Mr. MOORE:

Q. Mr. Hamilton, do you contend that a comparison of the cost of operation of the proposed Roanoke Rapids plant, assuming Buggs Island not to exist, in comparison with assuming Buggs Island to exist, would not be a proper approach to determine the downstream benefits?

A. No.

Q. You don't contend that?

A. No.

Q. At page 992 of the transcript you emphasize there was a risk as to actual delivery of energy and capacity and that this was a reason why, in your thinking, investment by the company at Roanoke Rapids would be uneconomical. Would not this risk also be one to which the United States would be exposed if it were to develop the project at Roanoke Rapids?

A. Yes.

* * * * * *

[1176] By Mr. MOORE:

Q. Would not that risk be one to which the United States would be exposed if it were to develop the project at Roanoke Rapids?

A. Yes, but their exposure would be far less because their cost of operating the project would be far less.

Q. That is because of the two per cent money and no taxes?

* * * * *

By Mr. MOORE:

Q. Is there not a substantial risk in the construction of a steam equivalent by the company that the price of coal and labor may greatly increase and add to expense of the operation of the steam plant? Aren't there very substantial risks in that method of handling the matter?

A. The risks are not nearly as great and they are not considered as great by operators of utilities. Then there is far more margin with a steam plant than there is with a hydro plant.

[1177] Now, if we should put in a modern plant that had $10 coal, we could operate for about 3.76 mills per kilowatt-hour for fuel. If we did operate for 3.76 mills per kilowatt-hour that steam plant would turn out 376 million kilowatt-hours, which is 16 hours' operation, at a fuel cost of $1,414,000. So that a fuel plant has more margin and greater use than has the hydro. Consequently, I say this margin is favorable in the way of risk to the steam plant.

Q. Is it not true that the two major elements in costs of the operating of the steam plant are the cost of coal and the cost of labor?

A. No.

Q. In the cost of operation, I am asking about.

A. In the cost of operation?

Q. Yes.

A. Yes, principally fuel.

Q. What was the price of coal, approximately, in 1939, just before the war, as compared to $10, as shown by the evidence today?

A. It cost your people $4 at the Richmond plant, and $4.25 at the Reeves Avenue plant at Norfolk.

Q. Between $4 and $4.25 it is costing?

A. Yes.

Q. You are using how many tons of coal on an annual basis in your figures?

[1178] A. That would be 12/15ths of a pound per kilowatt-hour, times 376 million kilowatt-hours.

Q. I understand that the present consumption of coal on the power company's system is running at about a million and a half tons per year.

A. I don't know what it is running, exactly. I know that the Reeves plant turned out in '47, 562 million kilowatt-hours, and they used 16,402 B. t. u.'s per kilowatt-hour, and the B. t. u.'s per pound of coal per kilowatt-hour was 15,930.

Q. Would you consider that——

A. I am sorry, I got that twisted. The plant used 16,402 and the coal contained 15,930.

Q. Would you consider that that increase in the cost of coal from $4 to $4.25 in 1939, to approximately $10 at the present time, as applied to a million and a half tons of coal was a major risk in the operation of steam plants on the company's system?

A. That is a risk in rising cost over nine years.

* * * * * *

Q. I mean risk in respect of the whole investment.

[1179] A. Yes; I would consider that a risk.

Q. I asked you, would you consider that a major risk?

A. Starting when, starting as of today?

Q. Yes.

A. No; I would not consider that a major risk.

Q. As of today?

A. No.

Q. Why not?

A. Well, I happened to be in Venezuela for the last four months. They are unable to sell their oil there. They had to cut back some 25 percent. A couple of years ago, when I was with the Interior, I was asked to try to help one of the railroads get a contract for oil, and we could not get any contract for oil. I tried to get the Navy to release some of its oil so they could operate utilities in the northwest and couldn't get any oil.

Today there is so much oil they don't know what to do with it, so they have cut down in all the fields, some much higher than 25 percent. Consequently, they are not confronted with a lack of supply of fuel.

Q. How about labor? Labor is very much less in the hydro plant at Roanoke Rapids than it would be in the steam plant, is that right?

A. Yes, sir.

Q. How do labor costs, according to your figures, compare [1180] today with those in 1939, applicable to such operations?

A. I haven't the labor costs for 1939, but I would say the labor costs are up.

* * * * *

Q. Do you regard the risk in increased labor costs as compared with prewar conditions as a major risk involved in the operation of a steam plant at Roanoke Rapids, as compared with the hydro plant?

A. I don't consider it a major risk, no.

Q. You mention on page 992 of the transcript what you consider to be numerous advantages in steam generation over hydro generation. Are there not numerous advantages also in hydro generation that are not afforded by steam production in a certain percentage of hydro plants being available for power in [1181] an electric power system, as a supplement to steam power.

* * * * * *

Q. Are there not obvious advantages in hydro also in comparison with the steam?

A. There are, if it is a dependable hydro.

Q. Are you prepared to deny that the advantages that Mr. Cary stated in his judgment would accrue to the VEPCO system for its service to the public, the general unvalued advantages from the hydro generation at Roanoke Rapids, in lieu of the construction of the steam plant equipment, would not exist in this case, in the case of constructing the hydro in place of the steam at Roanoke Rapids?

* * * * * *

[1182] A. I can't tell if they are sure to exist there. They will exist if he has water. They may not exist if he does not have water in the way that he wishes to employ them. Here we have a hydro that would have a lot of advantages if you could just press a button and have the governor opened up and put the plant

on the line. Here we have a plant that you cannot get up to capacity for 90 minutes. It isn't like a plant where you just throw in 90,000 kilowatts like you do with a steam plant. If you have 90,000 spinning reserve, all you have to do is open the governor, but if you have 90,000 water reserve and you wish to run it, you have to wait 90 minutes before you can get it on.

Q. So what you contend is these unvalued advantages would exist in general, but they do not exist as to this particular plant?

A. That is right.

* * * * *

[1183] By Mr. GATCHELL:

Q. Mr. Hamilton, I have no desire to be repetitious but while the matter is still fresh in my mind there are two things I am not quite clear on that are not in the questions I have prepared for you for cross-examination, that I would like to ask. The first question is: As I have listened to your testimony I gathered the impression that there are two physical limitations on the operation of the Roanoke Rapids project by the Virginia Electric and Power Company as a peak load plant, and those two limitations are, first, that they have no contract with the Secretary of the Interior. Is that one limitation?

A. That is one; yes, sir.

Q. The other limitation, as I get your testimony, is that they are limited in the rate of variation of discharge past the Roanoke Rapids project by reason of some limitation that the Army Engineers have suggested. Is that the other limitation?

A. That is the other limitation.

Q. Are there any other physical limitations on operation of the Roanoke Rapids plant as a peak load plant on the Virginia Electric and Power Company's system load?

A. Well, there is the ability to vary the flow in the downstream channel and get away with that.

[1184] Q. I mentioned that as the second limitation. That I understand you regard as being imposed by the Army Engineers. Is that correct?

A. That is so set out by the Army Engineers but the public——

* * * * *

Q. Do you have any other physical limitations in addition to the two which I mentioned?

A. One is the variation in speed. The other is the variation in the quantity of water that may be required to be passed at all times.

Q. What other physical limitations do you have that would prevent operation of the Roanoke Rapids project on the peak loads of the Virginia Electric and Power Company's system?

[1185] A. Well, one limitation is the passing of the thousand second-feet all the time so that on Saturdays and Sundays when you have to pass a thousand second-feet you don't gain in storage or in pondage. The other feature is that maybe the public is not going to stand for varying from 1,000 to 18,000. They may stand for a smaller variation within closer limits.

Q. Suppose the Roanoke Rapids project is not constructed for a good many years, would you vary

the operation of the Buggs Island project so as to take care of this downstream effect that you mentioned?

A. The amount of discharge from Buggs Island would depend entirely on the marketing requirements of Buggs Island.

Q. You do not regard the limitation of the downstream effect as applicable to Buggs Island?

A. I certainly do. If the Buggs Island discharge varied to any large degree it would be subject to the same limitations. But the Buggs Island project is not subject to any limitations on incoming water, it is able to take all the water that flows into the reservoir except unusual floods.

Q. But that has nothing to do with the rate of discharge past the power plant, does it? The variation in the rate of discharge is controlled at the power plant, is that not right?

A. That is when the water is down. When the water is up above the capacity of the power plant then the storage is **[1186]** either handled by the gates or by the spillway—I mean the flow is covered by the gates or the spillway.

Q. This thousand second-foot limitation, is that what the Department of the Interior is going to recommend as to the requirement for fish and wildlife?

A. I don't know what they will ultimately recommend.

Q. You mentioned that yourself. Where did you get that figure?

A. I find it in Charles T. Main's report.

* * * * *

The WITNESS. On page 5 it states at the bottom of the page, "Requirement of the minimum of continuous discharge of a thousand second-feet downstream from site B."

By Mr. GATCHELL:

Q. And that is the limitation that you mentioned now?

A. Yes.

Q. You don't know whether it may be more or less than that figure?

A. There is one letter I saw where it was set out that they might need two thousand second-feet during the spawning [1187] season for two months, April and May, if I recall correctly.

Q. And where is that found?

A. That is found in a letter, I think, from the Fish and Wildlife.

Q. In your consideration of it—and that is what I am dealing with—where have you regarded this limitation on the discharge, the change in discharge between 1,000 and 18,000 second-feet as being restrictive? Who has imposed that restriction, as far as you know?

A. The letter from the U. S. Engineers setting out a thousand second-feet.

Q. If it was in the letter from the Army Engineers we can read it, but I would like to know if the letter to which you have reference is Exhibit number 8. I am not asking you to read it to us but merely to tell us if that is the letter you have reference to.

A. It mentions a thousand second-feet.

Q. I am just asking you if that is the letter. I am not asking you to read the letter or the figures.

* * * * *

The WITNESS. This is one of the letters.

By Mr. GATCHELL:

Q. Is there another letter from the Army Engineers?

A. Yes.

[1188] Q. I show you Exhibit number 11, a letter dated May 2d. Is that the letter? Just yes or not, that is all I want.

A. No.

Q. I show you Exhibit number 9, is that the letter?

A. No.

* * * * *

[1189] By Mr. GATCHELL:

Q. The other matter that was troubling me, Mr. Hamilton, this afternoon as I listened to your answers—and I am not quite clear; I would like to have my understanding cleared up if I could, please, sir—is it your view that the United States could construct the Roanoke Rapids project more cheaply than the Virginia Electric and Power Company, aside from the question of the cost of money?

* * * * *

[1190] A. The United States Engineers are building more projects than the rest of the world combined and they certainly should be able to build a project at less cost than anyone else.

Q. I asked you if you assumed that the Army Engineers or the United States could build the Roanoke

Rapids project more cheaply than Virginia Electric and Power.

A. No; I did not assume that.

Q. In making your analysis of the situation at Roanoke Rapids did you visit that area?

A. No; I have never been on the site.

Q. Do you know that the original proposal was for enlarging the canal, constructing a canal and enlarging the canal down there in addition to the power plant which was to be built up on the river; is that right?

A. Enlarge the canal and extend the canal.

Q. Is it your proposal or your recommendation that the plan as proposed in House Document number 650 for Roanoke Rapids should now be carried out?

A. I didn't make any recommendations.

Q. Do you make that recommendation?

A. I haven't made any.

Q. You have not?

A. No.

* * * * *

[1196] By Mr. GATCHELL:

Q. Do you have Exhibit 10, Mr. Hamilton? That is the Definite Project Report.

A. Yes.

Q. Would you turn to page 15 in that report, paragraph 54?

A. Yes, sir.

Q. Do you see in that paragraph the statement that there has been a greater storage allocation to

flood control through lowering of the maximum power pool from elevation 312 to elevation 300? Do you see that?

A. Yes.

Q. Is that a substantial variation in your opinion?

A. That is.

Q. What does it say about the reduction in firm energy?

A. "This revision results in a 28 per cent reduction in firm energy and a five per cent decrease in annual energy generation. However, the total power value—"

Q. I do not have any objection to you reading the balance but I don't know that it is pertinent right at this [1197] time.

* * * * *

The WITNESS. It says the project's value has been increased. I think that is very pertinent to the questions you have been asking.

* * * * *

The WITNESS. I would like to read the balance of the paragraph.

* * * * *

A. "However, the total power value and thereby the total project value has been increased by the addition of dependable generating capacity and the consequent increase in prospective returns from the sale of power in the market area within which the Federal Power Commission indicates a higher value for power than was contemplated by the District Engineer in the project document."

Q. That is all you care to read?

A. Yes.

Q. While I am on that point, because I will forget it [1198] if I don't, this talks about the addition of dependable generating capacity. You have used the term "dependable generating capacity." How have you used that term? What definition would you give to your use of the term "dependable generating capacity?"

A. I never used that term.

Q. I thought you had used the term "dependable capacity" consistently in your testimony. What did you use?

A. Dependable capacity.

Q. Is there some difference between dependable generating capacity and dependable capacity?

A. One is dealing with firm energy and one deals with capacity.

Q. I am learning something every day. What is your definition of the term "dependable capacity" as you used it?

A. My definition was that at any time they needed 91,000 kilowatts of capacity on the peak hours, that that would be available any time. Now, when you talk about generating energy, generating capacity, we talk about a different figure. We can talk about firm energy available say 90 percent of the time. There is a marked difference between having capacity available and having generating energy available. Capacity has to be available all of the time.

Q. What is the difference between dependable capacity and dependable generating capacity?

[1199] A. Well, when you speak of generating capacity you are dealing more with energy than you are when you speak of dependable capacity.

Q. You speak of firm capacity and firm energy. You referred to firm energy in your direct testimony. What did you mean by that?

A. If you are treating a water power project you generally assume that if energy is available 90 per cent of the time that is considered as firm generating capacity or firm generating capability. But that is not so with capacity.

Q. I was asking you not about firm capacity, Mr. Hamilton. I was asking you about firm energy. You used the term "firm energy." What do you mean by that?

A. Firm energy, as a general definition, is the energy that is available 90 per cent of the time.

CHIEF PRESIDING EXAMINER. But dependable capacity, you say, must be available 100 per cent of the time?

The WITNESS. No; must be available during the peak hours 100 per cent of the time.

By Mr. GATCHELL:

Q. In your study, preparing for this particular project, I assume you made some system load studies, did you?

A. No; I did not make any system load studies.

Q. You have served as consultant a good many times. Isn't that the customary practice?

[1200] A. It depends on what you are dealing with. If you are dealing with the installation of a steam

plant that you know is available all of the time, then you will study your system characteristics. But when you are dealing with a hydro project, only available part of the time, then it is almost impossible to project your load 50 years ahead, so that the hydro plant may not become as useful as was anticipated, while with the steam plant you always have the use.

Now, here is a system which has grown, if I recall correctly, in the neighborhood of 40,000 kilowatts a year. One cannot make a mistake in buying a new modern steam plant. They can make an awful mistake by going into a hydro plant that might not fit the particular conditions. The steam plant is bound to fit the particular conditions.

Q. Regardless of what kind of a load you are going to serve with that steam plant, it is bound to fit the conditions?

A. Yes; because with a steam plant you immediately jump into a very high efficiency steam plant. You get high efficiency. While with the operation of the fuel now required to operate the plant, it reveals the fact that the steam plants they now have are not highly efficient plants.

Q. That is, you mean the Virginia Electric and Power Company plants which it now operates, its steam plants, are not efficient plants?

A. Yes; the one I referred to.

[1201] Q. Which one is that that you referred to? You referred to quite a number of them.

A. I referred to it in my testimony.

Q. I don't know which one that is, but that is all right, if you don't know which one it is.

A. No; I will find it here in a minute. That was the Reeves plant which in 1947 took 16,402 B. t. u. per kilowatt hour.

Q. And you think that is an inefficient plant that would not be constructed at this time?

A. If you were going to put in a plant at this time you would put in a plant that would run under 12,000 B. t. u.

Q. By that you mean 12,000 B. t. u. per kilowatt hour?

A. That's right. A 1,250-pound plant at 960 degrees Fahrenheit would take 11,250 B. t. u. at 100 percent load factor. If it was operated at 50 percent load factor it would take 11,800 B. t. u.

* * * * *

[1203] Q. Now, so far as applied to the Roanoke Rapids project and the Buggs Island project, this possibility of a change in the stream flow would not have any consideration by you, would it? You would not regard the probability of change in the flow of the Roanoke River as worthy of consideration for either the Buggs Island or the Roanoke Rapids project, would you?

A. Yes.

Q. You would?

A. Yes; because the Roanoke Rapids without storage hasn't a chance to equalize. The Buggs Island with storage has a chance to equalize. It makes a big difference if one is operated without the other.

* * * * *

[1206] Q. Mr. Hamilton, as I understand your testimony, you evaluated the capacity value of the Roanoke Rapids project, [1207] did you not?

A. I arrived in my mind at what I thought was its capacity value.

Q. Did you arrive in your mind at what you thought was the energy value?

A. Yes, I did.

Q. What was that?

A. That was the amount of energy that would be available 90 percent of the time.

Q. Do you have Exhibit 51 handy?

A. Yes, sir.

Q. I have some difficulty in following this, Mr. Hamilton. Maybe it might assist if we just numbered the columns. There are 11 columns in this table, as I look at it; is that right?

A. Yes, sir.

Q. Now, I read very carefully the statement and I heard the statement which you made as to what these columns show, but I think in order to clarify it, I would have to ask you if my understanding is correct. When I look at column 4 in the first line, would I get the figure showing the flow that would have to pass this plant throughout a 24-hour period?

A. No, sir. That is the flow that would result from operating the plant at full load for one hour, plus the amount of water that would be necessary to bring the plant up to full capacity.

[1208] Q. In other words, in one hour it would pass 18,050 c. f. s.?

A. Yes, sir.

Q. In order to get up to that flow it would have to start before the beginning of the hour and would have to continue after the end of the hour? When did you figure it would start, how many minutes or hours before?

A. An hour and a half.

Q. An hour and a half prior to the beginning of the hour when it operated at full capacity?

A. Yes, sir.

Q. And was that starting at zero?

A. No.

Q. What was the flow at the time it started?

A. A thousand second-feet.

Q. And for how long a period after the hours of full operation did it operate?

A. I planned that it would be shut down.

Q. Immediately upon the end of the hours?

A. That is right.

Q. Now, then, you have daily c. f. s. in column 5 at 1,000 second-feet. What is that?

A. That is 1,000 second-feet multiplied by the hours the plant would not be in operation.

Q. You mean that for 23 hours it is not in operation at——

[1209] A. No, sir; for 21½ hours it would not be in operation.

Q. I am sorry.

A. For 21½ hours it would not be in operation.

Q. For 21½ hours it would not be in operation?

A. That is right.

Q. For one hour it would be in operation at a thousand second-feet?

A. For each hour of the 21½ hours a thousand second-feet would pass down the river.

Q. I beg your pardon. Then during the balance of the time would it be shut down?

A. When it is shut down a thousand second-feet would have to be passed, and the period of shut-down is 21½ hours.

Q. The exhibit certainly was not clear, and I am glad to have that straightened out. Now, would any of that water be used through the plant in your studies?

A. A thousand second-feet would amount to about 5,300 kilowatts, and that could be used for fuel saving.

Q. There are four units that they propose here. Now, which one of the units would it go through?

A. Naturally, I believe, you would have to pass water down through the old plant. However, that might be the function of the operator as to which unit he would select to pass down the second-feet.

Q. You haven't given any attention to that phase of it?

[1210] A. No, sir.

Q. Are there three units of 27,000 kw. each?

A. That is correct.

Q. And what is the hydraulic capacity of those wheels; is it 5,150 second-feet?

A. No; my recollection is a little bit higher than that. The three units coupled with the other unit would take 18,050 second-feet. If we divide 5.3 into 91,000 you will get the second-feet, and if you divide that by three you will get the second-feet per unit.

Q. There is another unit of 10,000 kilowatts capacity.

A. Yes.

Q. When the full capacity is in operation, is that small unit of 10,000 kw., would that be operating, in your opinion?

A. That would be up to the applicant whether he elected to operate that or not.

Q. It wouldn't increase the total hydraulic capacity above 18,050 second-feet?

A. No, sir.

Q. That is the way you have studied it?

A. That is right.

Q. Now, in the next to the last column on Exhibit 51, that is, column 10, are those entries based on natural monthly mean discharges at Roanoke Rapids?

A. Each month's discharge at Roanoke Rapids would be [1211] less than 1,580 c. f. s.

Q. My question is, is it based on the mean monthly discharges?

A. Right.

Q. Natural mean monthly discharges?

A. That is right.

Q. Is that true of the final column, is that based on the natural mean monthly discharges at Roanoke Rapids?

A. Right.

Q. Did you adjust the discharges which you show on sheet 2 of Exhibit 51 for Gaston for the years 1911 through February 1930; did you adjust those for flows at Roanoke Rapids?

A. No; I didn't adjust any discharges from Gaston to Roanoke Rapids.

Q. You just took the figures as they are published in the water supply papers and put them on this table?

A. That is correct.

Q. Are the flows at Gaston precisely the same as they are at Roanoke Rapids?

A. There is a variation of approximately—there is a variation of seven per cent, I believe, in drainage area.

Q. My question is, does that mean that the discharges at Roanoke Rapids are precisely the same as they are at Gaston?

A. In the low-water period they would very closely approximate the same.

[1212] Q. What do you mean by low-water period? What is the maximum of the low-water period?

A. I mean in the dry season when the water is down in the smaller drainage area it is more likely to be dry than in the larger drainage area.

Q. What do you regard as a low-water flow for that purpose?

A. I didn't take that into consideration because I didn't have any record giving the flow.

Q. And you don't care to tell us now what would be a low water flow for the purpose of comparing Gaston with the Roanoke Rapids discharge?

A. I don't have the information, so I cannot tell.

Q. Now, as I look in the last column on Exhibit 51, sheet 1, the last line says that 25 per cent of the

time there would be a discharge of 9,192 c. f. s., is that right?

A. Yes.

Q. That is just 25 per cent of the time?

A. That is a straight reference to the natural flow curve.

Q. With no adjustment for increase at Buggs Island?

A. That is right.

Q. Now, as I look at Exhibit 51, this 9,192 c. f. s. would be the mean monthly flow required to operate the Roanoke Rapids project the full capacity of 91,000 kilowatts?

A. Yes.

Q. Five days a week for 16 hours a day.

[1213] A. Yes, sir.

Q. You would indicate that the Roanoke Rapids project would not have engineering feasibility to meet a 16-hour operating schedule five days a week without Buggs Island in operation 16 hours a day. Did you have in mind any particular time during the day when Buggs Island would have to operate 16 hours a day?

A. I don't believe I made any reference to Buggs Island operating 16 hours a day.

Q. Well, maybe we can find it.

Was it your thought that the applicant would have to enter into a contract with the Secretary of the Interior in order to be assured of a flow of 9,192 second-feet per month average in order to permit

them to operate the Roanoke Rapids project on that 16-hour schedule five days a week?

A. Yes, sir.

Q. How much energy per week would be generated by the Roanoke Rapids project if it operated at full capacity for that 16 hours a day? Would that be five times 16, which is 80, times 91,000 kilowatts?

A. Right.

Q. Does that give you 7,280,000 kilowatt-hours?

A. Right.

Q. Do you happen to have page 989 of the transcript before you?

A. Yes, sir.

[1214] Q. Would you mind looking at lines 10 to 14 on that page.

A. Yes, sir.

Q. Were you not asked the question:

> Would you conclude from that that the Roanoke Rapids project does or does not have engineering feasibility to meet the operating schedule without Buggs Island in operation 16 hours a day?

And you answered:

> It does not.

Do you see that?

A. Yes.

Q. What 16 hours a day did you assume Buggs Island would have to operate to answer that question?

A. The regulated flow of Buggs Island is 6,850 feet.

Q. You mean second-feet?

A. Second-feet. The question is how you can bring that up to 18,000 second-feet. The hours of operation would have to be such each day that would result in 18,050 second-feet being made usable at the Roanoke Rapids project, less the benefits they might get from their pondage if the pondage was used as storage.

Q. My question is, what 16 hours did you assume Buggs Island would have to operate, during the day, during the night, or part in the day and part in the night?

[1215] A. They would have to operate somewhat in advance of the time it would take water to get to the Roanoke Rapids project, unless the Roanoke Rapids project pondage is used as storage.

Q. Could it be so used?

A. It could, but once the storage as pondage is empty, it might not be available in future days. It isn't good engineering, to my mind, to spend $26,000,000 on the theory——

* * * * *

[1216] By Mr. GATCHELL:

Q. Now, returning to the Roanoke Rapids project, you gave us a figure of 7,280,000 kilowatt-hours as being turned out at the Roanoke Rapids project if it operated at full capacity for 16 hours a day for five days a week. That was the computation you just made?

A. Yes, sir.

Q. How much energy would be generated during the calendar year based on 51 weeks of operation after due allowance for holidays considered as one week? Would that merely be 7,280,000 times 51?

A. Times 52, would it not?

Q. Well, I am taking a week out for holidays.

A. It has already been taken out.

Q. Will you assume a 51-week year for my purposes?

A. Yes, if you multiply the 51 by the seven million plus kilowatt hours——

Q. Would that give you approximately 371,000,000 kilowatt- [1217] hours?

A. Yes. I figured it at 376, in connection with the steam plant's operation over the same period.

Q. I believe you misstated yesterday—I don't happen to have it here—but you said the Roanoke Rapids pond had a usual capacity of some 4,800 acre-feet; you meant second-foot days, did you not? Isn't it a capacity of about 10,000 acre-feet, as proposed by the applicant?

A. My answer was in second-feet. I said if the surface acreage was 4,900, that the second-feet days would be about half that, or 2,500 second-feet—days.

Q. Now, what draw-down do they propose, what draw-down did you assume at the Roanoke Rapids project as proposed by the applicant?

A. Two feet was mentioned as the draw-down in other testimony. That would be 5,000 second-feet days.

Q. Or about 10,000 acre-feet of pondage?

A. That is correct, providing you can operate the storage at the spillway elevation, but it is not from a practical point correct if you are going to operate the pondage——

Q. Now, Mr. Hamilton, if you will just answer the questions I ask we will get along.

A. My answer to the second-feet is no, instead of yes.

* * * * *

[1220] Q. Mr. Hamilton, as I understood you yesterday, you had made no load studies of the Virginia Electric and Power Company system operations.

A. That is correct.

Q. You have made no monthly load studies, no weekly load studies, or daily load studies?

A. Only in the studies that appear in the report of the Charles T. Main Engineering Company.

Q. All right, now, what are those, are they monthly?

A. Monthly.

Q. They are all monthly, are they not?

A. Yes, sir.

Q. So that you do not know how the Roanoke Rapids plant could be operated on the load of the Virginia Electric and Power Company system, so far as its weekly or daily operation is concerned, do you?

A. I do not know how they would operate it, nor do I believe they know how they would operate it in the years to come.

Q. But you have not made any load studies to determine how it would fit into the present load pattern, have you?

[1221] A. No, I have not.

Q. And that includes load studies hour by hour?

A. No.

Q. You have not made any such studies?

A. I have not made hour-by-hour studies.

Q. In your consulting work on studies of this kind, isn't it really customary to make a load study?

A. It depends upon what you plan on doing. If you are planning on a steam plant, then you know what size units you desire to put in.

Q. You did not do it here because you did not think it necessary for this purpose?

A. That is correct.

Q. You said that the Roanoke Rapids pond would have a usuable capacity of 5,000 second-foot days, is that correct?

A. No; I didn't say that.

Q. Did I misunderstand you?

CHIEF PRESIDING EXAMINER. He said he didn't say it.

By Mr. GATCHELL:

Q. Would it have that capacity?

A. If you eliminate the word "usable"——

Q. Oh, I beg your pardon. It has that capacity, but you do not assume it to be usable?

A. That is right, in this particular instance.

* * * * *

[1226] Q. We hunted through your testimony and it may be here, but I have missed it, but could you give us the firm energy that you used for the Roanoke Rapids project, the annual firm energy output?

A. With Buggs Island in operation and providing Buggs Island is operated as a firm energy plant, the low flow is 4,050 second-feet. If that second-feet is multiplied or converted into power at 90,000—converted into power over 74-foot head, it would give you the amount of firm energy.

Q. Have you that figure, or not?

A. I did have it on scraps of paper. I don't have it in front of me now.

[1227] Q. Don't you have it in your worksheets there? Was it about 188 million kilowatt-hours a year? I thought you used it in evaluating the project, but we could not find the figure.

A. No, I don't believe I gave that figure.

Q. Well, was it about 188 million kilowatt hours?

CHIEF PRESIDING EXAMINER. Isn't is just a matter of computation?

The WITNESS. Yes, sir.

By Mr. GATCHELL:

Q. Give me the factors and we can compute them, Mr. Hamilton. I don't want you to take time to make that computation.

A. It would be 4,050 second-feet.

Q. Times what?

A. 5.3 times 8,760 hours.

Q. What did you use for the average annual energy output, that is, the average annual energy?

A. For capacity plant, I don't think the average energy enters into the situation, so I only used the low flow.

Q. You mean you didn't use that in your studies?

A. No, sir.

Q. You did use Exhibit 29, this Charles T. Main report. Do you have that handy?

A. Yes, I have it here.

Q. Would your turn to the integrated energy capacity [1228] curve for December 1953?

* * * * * *

Q. Would you read off the amount of peak energy in the top 10,000 kilowatts from the peak?

A. 720,000.

Q. From the top 10,000 peak, starting at 720. Isn't it about zero?

A. Zero; that is right.

Q. The top 10,000 is about zero; pretty close to zero?

A. This curve shows zero a little above 720.

Q. Would you read off the amount of peak energy in the top 100,000 kilowatts for peak? That goes from 720 down to 620.

A. A little less than 2.5 thousand per megawatt hour.

Q. That is all I need that for at this time, Mr. Hamilton. Yesterday, When I was asking you about it, you said that there were some regulations prescribed by the Army Engineers that [1229] prevented the fluctuation in discharge past the Roanoke plant which, for your purposes, destroyed the usefulness of that plant as a peaking plant; is that correct?

A. Yes, sir.

Q. Now, what rate of variation did you have in mind?

A. Well, taking this particular instance, if we had the power plant operating, the system down to 620,000

kilowatts, and the capacity plant had ceased to operate and a unit dropped out, the capacity plant wouldn't be worth anything. You couldn't come back on the line to pick up the loss of that unit, so it would be rather ridiculous to have a capacity plant which is only going to operate on that particular phase of the load curve.

Q. That is, you assume this plant would be required to operate not only as a dependable plant but as a reserve plant?

A. If you wish to operate a capacity plant, a hydro plant, and if it has dependable capacity, when the dependable capacity backs off, or when the load backs off, you should be able to back off on your spinning steam reserve. But here with this hydro running you have got to keep a spinning reserve and steam so as to make sure you get service to your customers.

Q. You are suggesting this plant should perform the two functions of a spinning reserve?

A. It should be so able to do that without that; a plant that will only do certain things at certain times with many ifs [1230] attached to it. Therefore, I question the desirability of such a plant to operate up on the peak of the curve.

Now, Charles T. Main recognized that in their curves. They don't show in any curve I have seen where they have placed the Buggs Island project on the peak of the curve; on the peak of the load.

Q. You are assuming they would not carry additional reserve in their system?

A. The additional reserve is only from 10 to 15 per cent.

* * * * *

CHIEF PRESIDING EXAMINER. Had you or had you not?

The WITNESS. Yes. Every utility has to operate with reserve, or presumably so.

By Mr. GATCHELL:

Q. Now, what additional reserve did you assume for the Virginia Electric and Power?

A. I didn't assume any. Their records showed 10 to 15 [1231] per cent. I would think if they had reserve in excess of twice that, it would be nearer being on a good operating basis.

Q. But you did not assume any?

A. I didn't; no.

Q. Would you mind turning to page 994 of the transcript, at lines 13 to 14, you say: "It is contemplated to shut down the plant"—speaking of the Roanoke Rapids plant, "—over Saturdays, Sundays, and holidays."

If the Buggs Island plant serves the preference customers such as cooperatives and municipalities, will it not be necessary for that plant to operate some on Saturdays and Sundays, the Buggs Island plant?

A. Yes.

* * * * *

[1232] Q. Would it be possible to know what loads would be carried at the Buggs Island project on Saturdays and Sundays until after contracts have been let for serving the preference customers?

A. No.

Q. After such contracts have been let and the weekly load curve for Buggs Island operation has been established, would it not then be good operating practice for the Roanoke Rapids pool to be drawn down during the week or during Thursday and Friday, so as to store the water released from the Buggs Island plant on Saturday and Sunday?

A. That is something that is theoretical and might be beyond the control of the applicant, because if there is some unusual condition and they wished to operate the capacity plant, they may wish to operate it in a different manner. The pool might be full or it might be drawn down.

Q. Did you consider such a possibility in your study? Just answer that yes or no.

A. The possibility of it being drawn down or raised up or varied?

[1233] Q. Yes.

A. Yes; because I so testified that the pool above Roanoke Rapids is purely a pondage pool, it isn't a storage pool, and it can't be operated as both and operated to get the most out of the space.

Q. Could the company carry spinning reserve for its system by using one of the hydroelectric units at the Roanoke Rapids plant during Saturdays and Sundays?

A. I would say yes; they should be able to do that.

Q. Would that require much water?

A. If the wheels were designed so as to permit the passage of low water, that wouldn't be the case, but most of the wheels, when you get to within below 25

percent of the water that is required for normal operation, you get into pitting troubles.

Q. You mean, they could not carry spinning reserve, then, with a low discharge through the turbines?

A. It could be carried as spinning reserve if you took the water out of the wheel pit.

* * * * *

[1234] Q. You mentioned something about this fact of considering the time of operation of the Buggs Island project as related to the Roanoke Rapids project. What is the time lag between the water when it is discharged from Buggs Island until it would reach the dam at the Roanoke Rapids site?

A. I believe it has been testified to as eight hours.

* * * * *

[1235] Q. Now, on page 995 of the transcript, lines 19 to 21, you state:

> The projecting of stream flow and low flows based on past records does not mean that waters projected would actually take place.

Have you any better basis for estimating the future stream flow than use of past water-flow records?

[1237] Q. In order to be dependable on an annual basis, as you regard dependable capacity, is it your view that it is necessary for a hydro plant to be dependable to its full capacity for each month in the year?

* * * * *

The WITNESS. No.

By Mr. GATCHELL:

Q. It is not your view?

A. No.

Q. Would it be possible to have the Roanoke Rapids plant [1238] dependable to the extent of 91,000 kilowatts of capacity on an annual basis?

A. No; the 91,000 kw. of capacity should be available in the critical periods of heavy load, in the periods when excess machines are taken out of service.

Q. And that would not be dependable on an annual basis?

A. That might or might not be dependable on an annual basis.

Q. Would you consider the Roanoke Rapids plant to be dependable on an annual system basis to the full extent of 91,000 kilowatts if during one of the months in the year no flow came into the reservoir, but the system peak during that month, was 100,000 kilowatts less than the annual system peak load and the hydro plant was not needed during that month.

* * * * *

[1239] A. The answer is no.

* * * * *

My understanding of the question is if the peak load is 100,000 kw. less and you have equipment to handle the system and you don't need the hydro, then would you consider that the hydro would absolutely be necessary to the operation of the project? It that what you are driving at?

By Mr. GATCHELL:

Q. No; I am afraid that is not my question. My question is very simple.

[1240] Would you consider the Roanoke Rapids project dependable on an annual system basis to the full extent of 91,000 kilowatts if during one month of the year no flow came into the reservoir, but the system peak during that month was 100,000 kilowatts less than the annual system peak load, and the hydro plant was not needed during that month?

A. To that specific question, the answer is yes.

Q. The answer is yes. If the Roanoke Rapids plant were operated 16 hours a day for five days a week, what would be the weekly load factor? I get that by multiplying five times 16 and dividing that by 24 times seven.

A. That is right.

Q. Would that be about 47½ per cent?

A. I don't know what that calculation is.

* * * * *

[1242] Q. You mentioned this business of steam plant serving as reserve. How many hours would it take to put a unit on the line at a steam plant when the fires are drawn down?

[1243] A. Well, that is problematical. That isn't how a steam plant is operated. A steam plant is operated so that they can bring a unit into service very quickly.

Q. Do they keep it on the line all the time so as to have it there in case of emergency?

A. They do when they are operating as spinning reserve.

Q. Do they always operate all the steam plants as spinning reserve?

A. No; they operate spinning enough of the units to total the amount of power that would be necessary should the largest unit go out of service or the largest supply line go out of service.

Q. Wouldn't that be true whether Roanoke Rapids were built or not, by the Power Company, I mean?

A. No; yes, it would be true if Roanoke Rapids were built without Buggs Island.

Q. Wouldn't it be true whether Roanoke Rapids was built or not?

A. You mean if they didn't have any hydro power?

Q. Yes, sir.

A. Yes.

Q. If they did have, if Virginia Electric and Power Company did have Roanoke Rapids, wouldn't they still have to maintain some steam reserve spinning on the line?

A. I agree it would be desirable to do that, but the [1244] spinning reserve is only set out to be 10 to 15 per cent. Ten per cent of 750,000 kilowatts is only 75,000 kilowatts.

Q. What is the largest unit on their system?

A. The largest unit is capable of operating up to 70,000 kilowatts.

Q. Would you mind turning to Exhibit 10, which is the Definite Project Report, and look at the last plate in that volume, plate No. 55?

A. Yes, sir.

Q. I notice that has several curves ending in the lower right-hand corner and the middle curve is

entitled, "Regulated Flow." As I look at this graph the vertical ordinates are divided into blocks of one unit each; is that right? You can look at your left-hand scale and see.

A. Yes; that is correct.

Q. So that I would come down below the ten-unit mark to a point just a little above the 9,000 mark in order to get a flow of about 9,100, or thereabouts; 9,200 second-feet; is that right?

A. That's right.

Q. The horizontal ordinate is graduated, as I read it, in blocks that represent units of five; is that right?

A. That is right.

Q. So that if I wanted to find out how much this flow duration curve shows for the regulated flow at the Buggs Island [1245] Reservoir for a flow of about 9,100 second-feet, how much of the time would this curve show?

A. The flow would be available 25 per cent of the time.

Q. Now, I understood you to say that Exhibit 51 shows the flow of 9,192 second-feet available 25 per cent of the time?

A. Yes. That was with reference to the natural flow.

Q. All right, you just read off the regulated flow as being available 25 per cent of the time, why do you need a contract under those circumstances, a contract with the Secretary of the Interior to assure an assumed regulated flow of 9,192 second-feet?

A. Because it wouldn't be available in the lower flows of the river for 75 per cent of the time.

Q. Does that appear on plate 55?

A. Yes.

Q. Where?

A. We do not have it under 9,100 second-feet, from the 25-percent point over to the 100-percent point.

Q. I want to go to Exhibit 52, Mr. Hamilton, if you please.

A. Yes, sir.

Q. As I look at this exhibit you took from the total reservoir cost of $61,150,000, the sum of $14,680,000 as the proportion to be allocated to flood control; is that right?

A. That is right.

[1294] Redirect examination by Mr. HANKIN:

Q. Mr. Hamilton, on cross-examination you were asked if you had informed yourself of the charges made by the Federal Power Commission for downstream benefits, and you answered that question in the negative. Have you assumed, in your computations, that the Federal Power Commission would assess less than the benefits actually conferred?

A. In my belief they would not assess less.

Q. In computing downstream benefits of $690,000, did you set that as a maximum or a minimum?

A. I set that as a minimum.

Q. Then as Mr. Gatchell suggested there can be annual variations above that amount, can there not?

A. Yes, there can.

Q. On page 1183 of the transcript, you were asked about the physical limitations of the Roanoke Rapids project and you answered giving five limitations. I

believe the first was that there was no contract with the Secretary of the Interior; the second you mentioned was the ability to vary or inability to vary the flow; third, the variation in quantity of water; fourth, the requirement to pass 1,000 c. f. s. at all times; and the fifth, whether the public would stand for variations [1295] from the 1,000 to 18,050 c. f. s. Are these limitations sufficient to establish the nonfeasibility of the project?

A. I believe they are.

Q. You were asked on page 1189 whether the government could construct the Roanoke Rapids project more cheaply than the applicant, aside from the cost of money. Is the cost of money a material factor in the cost of construction and operation of the project?

A. It is a very material factor in the cost of construction inasmuch as this project extends over a long period of years and six years, I believe, is the time given by the Army Engineers, and inasmuch as the cost of money would be quite an item in the operating expenses.

Q. You were asked on page 1190 whether you recommended that the government construct the project as proposed in House Document 650, and you stated that you had made no recommendation. Is it your understanding that the Army Engineers must limit themselves to the plan in House Document 650 if they find a better plan?

* * * * *

The WITNESS. No; if the Army Engineers find a better project there is no reason why they can't

go to Congress and get an appropriation to build a better project.

[1296] By Mr. HANKIN:

Q. You stated on page 1112 that you had made no calculation of the feasibility ratios of the comprehensive plan under the present-day costs. Will you state whether, in your opinion, at present-day costs the Roanoke Rapids project would still be the most feasible project of the entire group of projects in the comprehensive plan approved by Congress?

A. It was the one having the greatest benefit; the greatest ratio.

Q. Would its withdrawal have a significant effect on the feasibility of the entire plan?

A. It would.

Q. On page 1106 of the transcript, you were asked with reference to your testimony that the elimination of the Roanoke Rapids project from the comprehensive plan would reduce the feasibility of the plan from 1.47 to 1.34 which you stated would be a reduction in the power benefits in the sum of $1,480,000. On page 1108 you stated that your answer was based on estimates made in House Document 650. You stated on page 1112 that you did not calculate the result under the present-day costs.

Can you give me a general estimate whether the figure would be materially greater or less if present-days costs were applied?

A. It would be far greater.

[1297] Q. On page 1129 you testified about the necessity of the leasing of pondage of Roanoke Rapids in the form of 24,000 second-feet per day, adding,

"in some form or other." I am quoting that phrase, "in the form of 24,000 second-feet per day, or in some form or other." Will you please explain the meaning of that statement?

A. That was 24,000 second-feet hours.

Q. In other words, is it the same thing as 1,000 c. f. s. over 24 hours?

A. Yes, sir.

Q. On page 1174, in answer to the questions on lines 4 through 7—will you refer to page 1174, please?

A. Yes, sir.

Q. Lines 4 through 7, there was a question. The question was:

> Mr. Hamilton, do you mean to state that the charge from apportioning Buggs Island storage cost would or should, in any case, exceed whatever is the actual benefit to Roanoke Rapids?

And your answer to that questions was, "Yes." Would you please explain your answer?

A. I think the answer is wrong. I do not think that Roanoke Rapids should be charged for benefits they don't get.

Q. In other words, was that an inadvertent error that should be corrected?

[1298] A. It should be corrected, yes, sir. Later on in my testimony I am quite sure I corrected it, but I made that clear.

Q. Some questions were asked of you concerning dead storage. Would you please explain what purposes dead storage serve?

A. Dead storage has to be created so as to get, or so as to support the reservoir for getting sufficient

storage for the operation of power, and also in order to get sufficient acre-feet for the impounding of flood waters.

Q. Does it serve any other purpose?

A. One of the other purposes is the absorption of silt.

Q. What would happen to the silt if there were no dead storage?

A. The silt would pass downstream.

Q. What would happen to the pond at Roanoke Rapids?

A. The pond would fill up in a very short period of time so that they would not have the pondage.

Q. If that is the case, what is your answer as to whether the cost of dead storage should be divided between Buggs Island and Roanoke Rapids?

A. I believe the cost should be divided.

Q. Will you please turn to page 1175. In answer to a question on lines 4 through 8, the question was, Mr. Hamilton:

> Mr. Hamilton, do you contend that a comparison of the cost of operation of the proposed Roanoke Rapids [1299] plant, assuming Buggs Island not to exist, in comparison with assuming Buggs Island to exist, would not be a proper approach to determine the downstream benefits?

In answer to that question your answer was, "No." Will you please explain that?

A. I think the proportion should be based on the cost to the United States government of the storage

in Buggs Island and not on the relative cost of operating the two plants.

Q. On pages 1161 through 1162, you were asked whether if Buggs Island were operated to the detriment of Roanoke Rapids, would there be any basis for downstream benefits, and your answer was that the government should not ask for payment unless benefits are actually rendered.

I now ask you this question: If no benefits are rendered to Roanoke Rapids, what do you say about the engineering feasibility of the project?

A. It would be nonfeasible.

Q. And if benefits are rendered, what do you say about the economic feasibility of the project?

A. It would be nonfeasible.

* * * * *

Testimony of Mr. Cary

DIRECT EXAMINATION

[1688] Q. Mr. Cary, you have heard Mr. Hamilton's testimony where he stated on page 1221, lines 14 through 24 of the transcript, that the pondage at the proposed Roanoke Rapids project would not be usable. Do you agree with his statement?

A. No, I do not.

Q. In your study of this problem, have you assumed that the pondage would be used?

A. Yes, I have.

Q. Will you explain how and to what extent you plan to use the pondage at the proposed Roanoke Rapids project?

A. We had this matter studied very carefully for us by Charles T. Main, Incorporated, and their findings are contained in Exhibit 29 of this proceeding in the paragraph beginning at the bottom of page 4, and extending over to page 5.

Our studies have been made on the basis that both Buggs Island and Roanoke Rapids would be operated as peaking plants and [1689] would be in operation for about 16 hours per day, not counting the minimum flow operation during the off-peak periods.

As stated in Exhibit 29, there is a time lag of about eight and one-half hours required for the water released from Buggs Island to reach the pond of the Roanoke Rapids project. This will require the Roanoke Rapids project to operate for about the first eight and one-half hours of the on-peak period almost entirely from pondage, as the only inflow to the pond during this period will be from the off-peak discharge of water at Buggs Island, which we assume would be the minimum flow required.

On this method of operation, the pond at Roanoke Rapids would be drawn down continuously during the eight and one-half hour period until the on-peak discharge from Buggs Island reached the Roanoke Rapids pond.

At that time further draw-down of the pond would cease and, under some conditions, may begin to rise.

At the end of the on-peak period generation the discharge of water from Roanoke Rapids would be reduced to the required minimum and the pond would continue to fill from the remaining on-peak discharge from Buggs Island.

By having our load dispatchers keep informed as to the generation and discharge of water at Buggs Island, they can so dispatch load on the Roanoke Rapids plant that the draw-down of the pond at the end of the on-peak period will be the proper amount, so that the remaining in-flow from Buggs Island will [1690] fill the Roanoke Rapids pond by the beginning of the next on-peak period, without wastage of water.

Calculations made for us by Charles T. Main, Inc., show that the maximum daily use of the pondage at Roanoke Rapids under normal operating conditions would result in a draw-down of less than three feet with daily recovery. For average and low flow conditions they found that the average draw-down would be about one foot.

In view of these studies by Charles T. Main, Inc., of the use of the pondage at the proposed Roanoke Rapids project, and my own knowledge of operating conditions on the system of Virginia Electric and Power Company, I see no justification for the statement made by Mr. Hamilton.

Q. Mr. Hamilton and other witnesses for the Secretary of the Interior several times expressed different interpretations of the testimony given by you appearing in the transcript at pages 147 to 148, and again at 446 to 454, in which you described how the proposed Roanoke Rapids project would be operated should the company be granted a license. Without going back over all that these witnesses have said, I will ask you to state further detail as to the manner in which the project would, as estimated by your company on the

studies made of the project, be operated on the system of the Virginia Electric and Power Company.

A. As I have testified, the proposed project would operate as a peaking generating station and would carry certain parts of [1691] the company's peak loads between the hours of approximately 7:00 a. m. and 11:00 p. m., during weekdays. I did not mean to indicate that the plant would operate only five days a week, as I consider Saturday a week-day, nor did I mean to indicate that it would never operate on Sundays, if load conditions should require it.

Our estimate of the on-peak period is that it will average about 91 hours per week.

During these on-peak periods, the generation on the proposed plant would vary with the water available and during substantial periods would carry its full capacity for a large part of the on-peak period.

At other times, when less water is available, the generation at the project may be reduced to such amount that it would carry only that part of the system load which could not be carried by the steam generation and other sources of power on the system.

Under this latter condition, the generation at the project would vary from hour to hour throughout the on-peak period, varying from light loads up to a maximum which might be the full capacity of the project, but on some days would be substantially less than full capacity.

Q. What were the principal purposes of the study made by Charles T. Main, Incorporated, as contained in their report, Exhibit 29, filed in this case?

A. Charles T. Main, Inc., was authorized to make a study [1692] for us to show whether both the entire output of the proposed Roanoke Rapids project and the entire output of the Buggs Island project could be absorbed and utilized in the system load of Virginia Electric and Power Company. That study was also for the purpose of determining the dependable and average annual energy output of both projects and the distribution of the output throughout the 12 months of the year.

The load curves and the load duration curves included in the report of Charles T. Main, Inc., are the curves of the estimated loads in the river flow year from June 1953 through May 1954, and for the months of December in the years 1954, 1955, and 1956, as estimated by the power company in its original studies of load growth made about December 1948.

As previously stated, we revised our load estimates at a later date, but did not consider it necessary to revise the curves used in this report. Using curves based on the original estimate makes the conclusions of the report more conservative than if curves had been used based on the revised and larger estimate of loads.

There are shown on the load duration curves and on the weekly load curves in Exhibit 29 the results of computations showing how the combined output of the Roanoke Rapids project, referred to therein as Site B, and the Buggs Island plant, in the critical river flow year, would operate on the system load of Virginia Electric and Power Company.

[1693] Also shown on these curves is the output for Buggs Island alone in the same critical river flow year.

On the weekly load curves for August 1953 and for April 1954, there is shown the manner in which the output of the Buggs Island plant alone and the combined output of the Buggs Island plant and the Roanoke Rapids project, in the average river flow year, would be absorbed into the system load.

Q. Do these curves, to which you refer in Exhibit 29, show the amount of power and energy required to be obtained from the Roanoke Rapids project?

A. No, they do not.

Q. Can such requirements be determined from these curves?

A. Yes. The power and energy requirements can be determined from these curves. In using the curves for this purpose, the results of computations shown thereon should be ignored.

Q. The report contains curves showing how Buggs Island plant alone would operate on the load of Virginia Electric and Power Company. In what way, if any, do these curves indicate how the Roanoke Rapids project would operate on that system without purchase of power from Buggs Island?

A. The general plan of operation of the Roanoke Rapids project without purchase of power from Buggs Island is indicated by the plan of operation for Buggs Island alone, even though the amount of dependable power and energy is somewhat different for the two projects in all months except December. In

December, [1694] due to the fact that the reservoir at Buggs Island will be drawn down substantially, the dependable capacity is reduced to about 89,000 kilowatts and the corresponding energy to 26 million kilowatt-hours. These two figures are sufficiently close to the corresponding figures for the Roanoke Rapids project of 91,000 kilowatts and 30,100,000 kilowatt-hours, as shown in table 8 of Exhibit 29, so that the Buggs Island operation indicated on the curves for December is approximately the same as for the Roanoke Rapids project without any purchase from Buggs Island plant.

Q. Do these load duration curves or the results of computations shown thereon indicate the number of hours that the Roanoke Rapids project would have to be operated to be dependable on the load of Virginia Electric and Power Company?

A. No, they do not. With other data, the number of hours could be computed from the curves.

Q. Do they indicate the number of hours that the Roanoke Rapids project would be operated?

A. Not directly.

Q. Will you explain what you mean?

A. On the assumption that the company should purchase the entire output of the Buggs Island plant and construct the Roanoke Rapids project, the operation of the two combined plants during the year of minimum river flow is indicated, and the bottom horizontal shaded line indicates the number of hours in each [1695] month that either one or both of the plants would be in operation for peaking, and I

think the number of hours of operation of each plant in the peak load period will be very near the same figure.

Q. Does the horizontal shaded line on those duration curves you referred to on those duration curves indicate the number of hours of operation at full load?

A. No, it does not.

Q. Mr. Cary, did you hear the testimony of Mr. Hamilton in which he stated that the Roanoke Rapids project could not be operated as a peak load plant?

A. I did.

Q. Do you agree with his statement?

A. No; I do not.

Q. Are you familiar with the recommendation of the United States Engineers as to limitation on rate of increase of discharge of water from the Roanoke Rapids project, as set out in Exhibit 8, which limitation was given by Mr. Hamilton as one of the reasons that the project could not operate as a peaking plant, in his opinion?

A. I am.

Q. Have you considered how this limitation would affect the operation of the Roanoke Rapids plant?

A. I have.

Q. Will you explain to what extent the limitation will [1696] affect the operation of the proposed project?

A. During the period of rapid increase in load in the morning from about 6:00 a. m. to 9:00 a. m., this limitation will require that the generators at the project be placed in operation and that the load on

the project be increased beginning about one-hour earlier than would otherwise be required. Such operation would simplify dispatching of load and would cause no physical difficulties at all.

The only adverse feature of such limitation is that a small amount of water would be used during the off-peak period which could otherwise be used during the on-peak period, and therefore have greater value.

The rate of increase in loads after 9:00 a. m., would require the release of water well within the proposed limitation.

Even under a hypothetical case which illustrates the extreme effect of such limitation, it would still be practical to operate the plant under the proposed limitation. This hypothetical case might be experienced if the project should generate only sufficient power and energy to make its full capacity dependable on the load during the week containing the peak load in the month of December.

Q. Have you had prepared an exhibit to illustrate this extreme operation that you refer to?

A. I have.

[1697] Q. I hand you a chart and ask you if this is a chart you prepared.

A. It is.

Mr. GIBSON. Mr. Examiner, I would like to have the chart presented marked for identification as "Exhibit 61."

CHIEF PRESIDING EXAMINER. It will be so marked.

Mr. GIBSON. The title of the Exhibit is, "Operation of Project No. 2009 and Existing Plants at Roanoke

Rapids Carrying Load above 624 MW. in week of Annual Peak of 720 MW. in December 1953."

(The document above referred to was identified as Exhibit No. 61.)

By Mr. GIBSON:

Q. I will ask you to explain what is presented by the exhibit you have prepared.

A. This Exhibit contains a curve for each of the five heavy load days during that week. Each of these curves shows the amount of load required to be carried by the project, together with the existing hydro plant at Roanoke Rapids, on the assumption that all except the top 96,000 kilowatts of load is carried by other sources of power.

The curves of hourly loads on the project show that power is required from the project for two hours on the Monday evening peak, two hours on the Tuesday evening peak; four hours on Wednesday morning, three hours on Wednesday afternoon, and [1698] two hours on the Wednesday evening peak; three hours Thursday morning, two hours on Thursday evening peak, and two hours on the Friday evening peak, with none required on Saturday or Sunday. That is a total of 20 hours when power would be required from the project.

During all other hours the project would operate at a minimum load of 5,000 kilowatts, including that generated at the existing hydro plant.

We find that during the morning and afternoon hours the rate of increase in load is within the permissible rates of varying the discharge, which is ap-

proximately 1,000 kilowatts per minute. For the evening hours, the rate of increase in load may be as rapid as 90,000 kilowatts per hour, and in order to meet the peak, which occurs between 5:00 p. m. and 6:00 p. m., we have assumed a rate of increase in plant load of 60,000 kilowatts per hour permitted by the proposed limitations set out in Exhibit 8, and have assumed that such increase would start sufficiently in advance of the peak to reach the required load at 5:00 p. m., and have indicated the actual generation exceeding that required by the load, and hence displacing steam generation, in the shaded area ahead of each evening's peak.

This generation in advance of the peak amounts to approximately 200,000 kilowatt-hours for the week. The generation required from the project, including that during the minimum [1699] flow periods under the assumed conditions, is 1,424,000 kilowatt-hours. The total generation at the project would be, therefore, 1,624,000 kilowatt-hours for the week, requiring an average flow of 1,825 c. f. s.

The conditions which are actually expected to exist during the period of these sharp December peaks is reasonably well illustrated on the estimated load duration curve for December 1953, contained in Exhibit 29. The estimated operation as indicated thereon shows, for either the combined operation of the Roanoke Rapids project and the purchase of the entire Buggs Island output, or for the operation of the Roanoke Rapids project alone, which I have stated will be for this month very similar to the operation

indicated for Buggs Island alone, that the extreme swing in the peak loads will be carried on the steam generating stations.

Q. Mention has been made in this case of spinning reserve. Would you plan to use the proposed Roanoke Rapids project if the company is granted a license, for the purpose of supplying spinning reserve on the company's system?

A. Only to a minor extent, as it will be necessary for the company to have adequate steam reserves to protect against the loss of a large steam generating unit and, in order to operate our steam equipment at efficient loads, we would want to operate at loads somewhat below their maximum capacity. Such operation for efficiency reasons automatically makes a [1700] substantial amount of spinning reserve available.

Q. On page 989, lines 1 to 5 of the transcript, Mr. Hamilton testified that the proposed Roanoke Rapids project would require an average flow of 9,192 second-feet to have sufficient dependable capacity for operating through 16 hours per day to warrant its construction. Do you agree with that statement?

A. I do not.

Q. Will you please explain why?

A. Mr. Hamilton's opinion is based on his conclusion that the plant cannot be operated as a peaking plant and must be operated at full load for the entire 16-hour on-peak period. There is no basis whatsoever for such a conclusion, as the limitations on rate of change of flow set out in Exhibit 8 are not such

as to render variations in generation impractical, as I have shown.

These limitations are recommended by the Army Engineers to assure safe conditions in the river below the project. I have testified and the curves in Exhibit 29 clearly show that to be dependable on the Virginia Electric and Power Company load, the project is required to carry the full 91,000 kilowatts only a small number of hours.

This was recognized by Mr. Wigglesworth in contrast with Mr. Hamilton and can readily be seen on "Estimated Load Duration Curve—December 1953" in Exhibit 29, by scaling down on the left [1701] hand scale from the peak load of 720 megawatts, 91 megawatts, to 629 megawatts, and reading out to the curve and down to the corresponding hours on the bottom scale, which reads approximately 50 hours. This means that the load is estimated to be in excess of 629 megawatts during only 50 hours of the entire month.

The curve also shows that the peak load of 720 megawatts is estimated to last for such a small number of hours as to be hardly determinable—something less than five hours.

Q. Mr. Cary, you have testified in this case, that you did not believe it necessary for the company to enter into a contract with the Secretary of the Interior to assure the water flows to the Roanoke Rapids project. Will you further explain your reasons for that statement?

A. Whether Buggs Island operates as a peaking plant, as a 24-hour operation variable load plant at average load factor, or as a base load plant in supplying loads of preferred customers or other utilities, will make little difference in value of the Roanoke Rapids project, because the pondage at Roanoke Rapids will be adequate to re-regulate the flow from Buggs Island, so that Roanoke Rapids can operate as designed.

The energy available each month from Roanoke Rapids, even in the critical river flow year, as shown in Table 8 of Exhibit 29, is many times that required, so that if the monthly generation at Buggs Island were substantially different from that [1702] assumed by the Army Engineers in Exhibit No. 10, the only result would be a redistribution of monthly generation at Roanoke Rapids.

* * * * *

[1703] Cross-examination by Mr. GATCHELL:

Q. Mr. Cary, when a steam generating plant is closed down and the fires are banked, approximately how long does it take to put a unit on the line?

A. I have some notes here that I would like to refer to on that. The more modern units, such as the units we are now installing at Chesterfield and Possum Point, would require [1704] from four to six hours, from a cold starting point to the time when it was placed on the line, and approximately another three-quarters of an hour to reach full load.

Q. On Exhibit 61, you show in the cross-hatched area the portion of the power which you regard as

being generated as off-peak energy; is that correct?

A. No; I did not intend to indicate that that was off-peak energy. It is definitely peak energy, but it is energy that is generated by the hydro project in excess of that actually required by the load. It is the energy that is generated by hydro during that period when it is anticipating load in order to be up to the proper generation, when it is actually needed at the crest of the peak.

Q. And the crest of the peak is the determining factor?

A. That is correct.

Q. Have you attempted, on this series of graphs, to show that as the load would actually occur? That is, as the load would come on to your line? Would the demand be created in as sharp a manner as you have shown on this series of graphs?

A. I am not sure that I exactly understood your question.

Q. Is this the result of the integrated readings on your load system?

A. Yes. These loads are all shown as hourly integrated loads, and not as the actual kilowatt load at any moment. The reason we did that is because we do not have an accurate record [1705] of the actual indicated load each minute. The only accurate load we have is the hourly integrated load.

I might add to that that due to the fact we did it this way makes the exhibit a more conservative statement than the conditions as they would actually exist.

Q. I got the impression you were suggesting this cross-hatched area indicated off-peak power, is that correct?

A. No; I did not intend to say that that was off-peak power. It was simply generation in excess of that actually required to carry out the operation assumed under this hypothetical condition.

Q. And your integrated load would build up more gradually than the sharp peaks as shown by the solid lines?

A. Oh, yes, somewhat more slowly. Our best estimates are that it goes up at the rate of about 90,000 kilowatts per hour.

* * * * *

[1956] Cross-examination by Mr. HANKIN:

Q. Mr. Cary, will you please turn to your Exhibit 61.

A. I have it.

Q. This represents the operation of Project No. 2009 and existing plants at Roanoke Rapids carrying the load above 624 megawatts in the week of annual peak of 720 megawatts in December 1953, is that correct?

A. It represents a hypothetical condition as I described in my testimony, and shows what the operation would be if we [1957] operated to carry the top 96,000 kilowatts, or all of the load above 624,000 kilowatts.

Q. When you say this is a hypothetical representation, does it mean that it is an estimated representation of how you would operate in December 1953?

A. No; it is not that at all.

* * * * *

[1961] Mr. GIBSON: Mr. Hankin, aren't you asking for exact figures to be computed by scaling from what is merely a graphic illustration? You can do the scaling yourself, if you find it necessary.

Mr. HANKIN. Unfortunately, Mr. Gibson, I am not the witness in this case.

CHIEF PRESIDING EXAMINER. Can you answer counsel's question and give him the information he requests?

The WITNESS. No, it would take considerable computation to do it, and I would not like to do it here on the stand.

CHIEF PRESIDING EXAMINER. You certainly cannot do it here.

The WITNESS. I can answer the figure in kilowatts.

CHIEF PRESIDING EXAMINER. You have heard his request, and if you can furnish it to him readily, you may do so, if you and your counsel think it is a reasonable request, or will do so at the request made. He said he cannot answer it now.

Mr. GIBSON. Mr. Examiner, I object to this line of questioning on the ground of the difficulty and delay imposed upon the cross-examination. Mr. Hankin is interested in bringing the data into the record, and I think it is up to him to do so.

* * * * * *

[1962] Mr. HANKIN. I asked the question whether the witness will be able to furnish us such data and I did not quite get the answer to that question.

The WITNESS. I can give rough figures fairly quickly. To give accurate figures would take some little time.

* * * * *

[1963] CHIEF PRESIDING EXAMINER. I think, Mr. Hankin, it is apparent you are not going to get that out of the witness just in the form you desire. Now, do the best you can otherwise.

The WITNESS. I would like to add this to that, that we could substitute for that exhibit negatives instead of positives [1964] for the same drawing, which would show—make it easier to read the scale.

Mr. HANKIN. I would like to answer the statement made by the Examiner.

Mr. Examiner, you will notice what I tried to do was exactly what you suggested. Since we cannot get this information from this graph, we have to do the best we can and the best we can under the circumstances would be to ask this witness hundreds of questions so that the data would be in the record.

Now, when I started to do that, counsel for the applicant objected. I admit that it would be a laborious thing to do, and I don't like to do it.

CHIEF PRESIDING EXAMINER. There is nothing we can do about that.

Mr. HANKIN. Oh, yes, your Honor.

CHIEF PRESIDING EXAMINER. No. The witness is on the stand now for cross-examination. If he desires to, or his counsel wants him to get up some further computations, graphs, or whatever you may be asking, I have no power to compel him to do it as a part of this cross-examination.

Now, if you think what he has put in evidence, what he has prepared, what he has testified is not supported fully without this specific thing you are

asking for, you may argue that, if he does not put in what you would regard as better support. But he is on cross-examination.

[1965] You have asked a question, and he cannot answer it.

* * * * *

Q. Now, Mr. Witness, let us start with a typical Monday in this extreme situation that you have presented on Exhibit 61. **[1966]** On Monday you would start with 1,000 c. f. s., and that 1,000 c. f. s. would continue until what time, approximately?

A. A little after 4:00 p. m.

Q. And then the discharge of water from the project would rise, is that correct?

A. That is right.

Q. Until it reaches what discharge?

A. Approximately 18,000 c. f. s.

Q. By what time?

Mr. GIBSON. Are you speaking of the hypothetical case?

Mr. HANKIN. I am now speaking of the hypothetical case.

Mr. GIBSON. In Exhibit 61?

Mr. HANKIN. Yes, and in order not to ask surprise questions, I shall ask him after each day in this hypothetical case to tell me what will be the normal operation.

The WITNESS. I would like to correct that. I gave the wrong answer to that question. That would not rise to 18,000 second-feet on that day. I don't know

exactly what it would rise to, but it is considerably less than 18,000 second-feet.

If you would like to have approximate figures, I think I can give them to you from the stand.

Mr. HANKIN. Please do it.

The WITNESS. I offered to do that before.

Mr. GIBSON. Mr. Hankin, do you object if I ask one clarifying question?

[1967] Mr. HANKIN. Not at all. I would like to have this thing clarified in any way that you would like to do it.

Mr. GIBSON. I would be more sympathetic if I could follow the purpose of your line of questioning. I simply wanted to ask Mr. Cary whether Exhibit 61 shows directly water flow, or shows power quantities.

The WITNESS. It shows power quantities, not flow.

Mr. GIBSON. In what way can you derive the water flow from Exhibit 61, only by computation?

The WITNESS. By a simple matter of division to get an approximate figure.

Mr. GIBSON. We will have to labor under that difficulty as we go along, at this point, is that correct?

The WITNESS. That is true, but each calculation would not take long after I find the proper factor to divide by.

* * * * *

The WITNESS. I can convert those power quantities into c. f. s. flow approximately by dividing each power quantity shown by 5.3.

[2281] REDIRECT EXAMINATION

By Mr. GIBSON:

Q. Mr. Cary, since the adjournment before the

week end, have you prepared, in response to Mr. Hankin's requests, a chart showing the estimated generation and discharge at the [2282] proposed Roanoke Rapids project?

A. I have.

Q. Will you describe generally the charts that you have prepared?

A. I have had prepared under my supervision five charts showing the estimated generation and discharge at the proposed Roanoke Rapids project, together with the Company's existing plant at Roanoke Rapids for a week of peak load in August 1953, the week of peak load in December 1953, and a typical week in April 1954, under critical river flow conditions and under average river flow conditions.

These charts show the generation and discharge for each hour of the week except on Sundays, and in some cases on Saturdays when the discharge for the entire day is the assumed minimum.

The minimum discharge has been assumed as that indicated in Table 3 of Exhibit 11, for the Roanoke Rapids project. The limitation on the rate of change in discharge has been assumed to be that proposed in Exhibit 8, and for the month of April, as indicated, to be further limited in footnote (e) of Table 3 of Exhibit 11.

Q. Did you in the preparation of these charts, assume the existence of Buggs Island?

A. Yes; I did, and I assumed that it would be operated as set forth in the Definite Project Report of the Army Engineers, [2283] Exhibit 10.

Mr. GIBSON. Mr. Examiner, I ask there be marked for identification as Exhibit 72, a chart entitled,

"Week of the Peak Load—August 1953—Critical River Flow Year."

* * * * *

By Mr. GIBSON:

Q. Will you give a brief description of the chart and how to read it?

A. The chart shows for each of the days indicated, the average load in each hour of the day and that is shown by the left-hand ordinate, expressed in mega-watts. The average discharge for each hour is shown by the same curve as indicated in [2284] the right-hand ordinate which is thousands of cubic feet per second.

The shaded area on the chart, and on the other four charts, show the estimated amount of generation and average discharge for the hour resulting from the assumed limitations on rate of change of flow.

Q. Are those assumed limitations set out in the text at the top of this chart and of each chart?

A. Yes, they are.

* * * * *

By Mr. GIBSON:

Q. With reference to the shaded area that you mention as appearing on the chart, does the significance of this shaded area mean that that area represents a waste of energy?

A. No, it does not. Such energy generated at the project and as indicated by the shaded area, reduces the amount of energy required from other sources.

Mr. GIBSON. Mr. Examiner, I would like to save time in the introduction and distribution of the re-

maining charts, and [2285] wish to introduce them now in evidence as Exhibits 73, 74, 75, and 76, with the titles appearing on those charts, and ask the witness for that purpose whether they are the remaining charts prepared as he described.

* * * * *

[2286] Q. Mr. Cary, I note that the chart for December 1953, which has been introduced as Exhibit 74, is for both average and critical river-flow years. Will you explain the reason why one chart covers both flow conditions?

A. The flow for the month of December, as determined in Exhibit 29, from data given in Exhibit 10 is the same for both conditions.

[2287] Q. Why is not the December chart, Exhibit 74, identical in appearance with Exhibit 61?

A. Exhibit 61 showed a hypothetical condition to illustrate the extreme effect of a sharp variation in load, and to show the effect of that sharp variation on the requirement for a gradual change in the rate of flow from the limitations recommended in Exhibit 8, the letter from the Army Engineers. The hypothetical condition there was not intended to represent the actual condition, but simply to show that the project could operate with a very rapid change in output with that limitation applied to it.

Exhibit 74, for the month of December, is intended not to show the hypothetical condition, but our best estimate of conditions that are expected to actually take place in December 1953.

* * * * *

[2288] Q. Will actual operation in any year be adjusted to the flow conditions and the changes in flow conditions actually encountered?

A. Of course.

Q. Is it your best estimate that the operations will follow the general pattern illustrated by these exhibits?

A. Yes, it is my best estimate that they will.

* * * * *

[5538] OBJECTION BY THE APPLICANT TO THE MOTION TO REOPEN THE PROCEEDINGS

* * * * *

[5559] 3. FEASIBILITY WITHOUT BUGGS ISLAND

Here the Secretary stands upon an assertion which is an egregious fallacy on the very facts which he advances; indeed the Secretary proceeds here completely disregarding that the precise reverse of his assertion is demonstrated by the very facts upon which he relies. Here he seeks reopening for further evidence on the claim that the record proves that the proposed project would have only 18,200 kw. of dependable capacity without Buggs Island.

In the first place, the proof upon which the Secretary relies (M., 5; S. R. B., 26–8) hangs upon a non-sequitur. At the hearing the Secretary called upon the Company to prepare an exhibit to portray the Company's estimate of the manner in which the plant would actually be operated with the conditions that will exist (R., 1953–4; 2280–2; 2287) namely, with the existence of Buggs Island. The Company complied with this request and Exhibit 74 was one of the series

of exhibits so prepared. The Secretary has now undertaken to conclude that this exhibit shows lack of dependable capacity in the case of operation without Buggs Island—when the exhibit is concerned solely with operation with Buggs Island and gives no data for construction of any tables or figures as to conditions without Buggs Island.

[5560] The Secretary's fundamental error lies in his failure to perceive that Exhibit 74 gives nothing to measure required operation—it gives nothing to measure the operation that the project must provide in order to afford 91,000 kw. of dependable capacity. This data is found nowhere in Exhibit 74. It is found in Exhibit 61, which shows the operation which is required—regardless whether Buggs Island is or is not in existence—in order to provide 91,000 kw. of capacity dependable upon the applicant's system load.

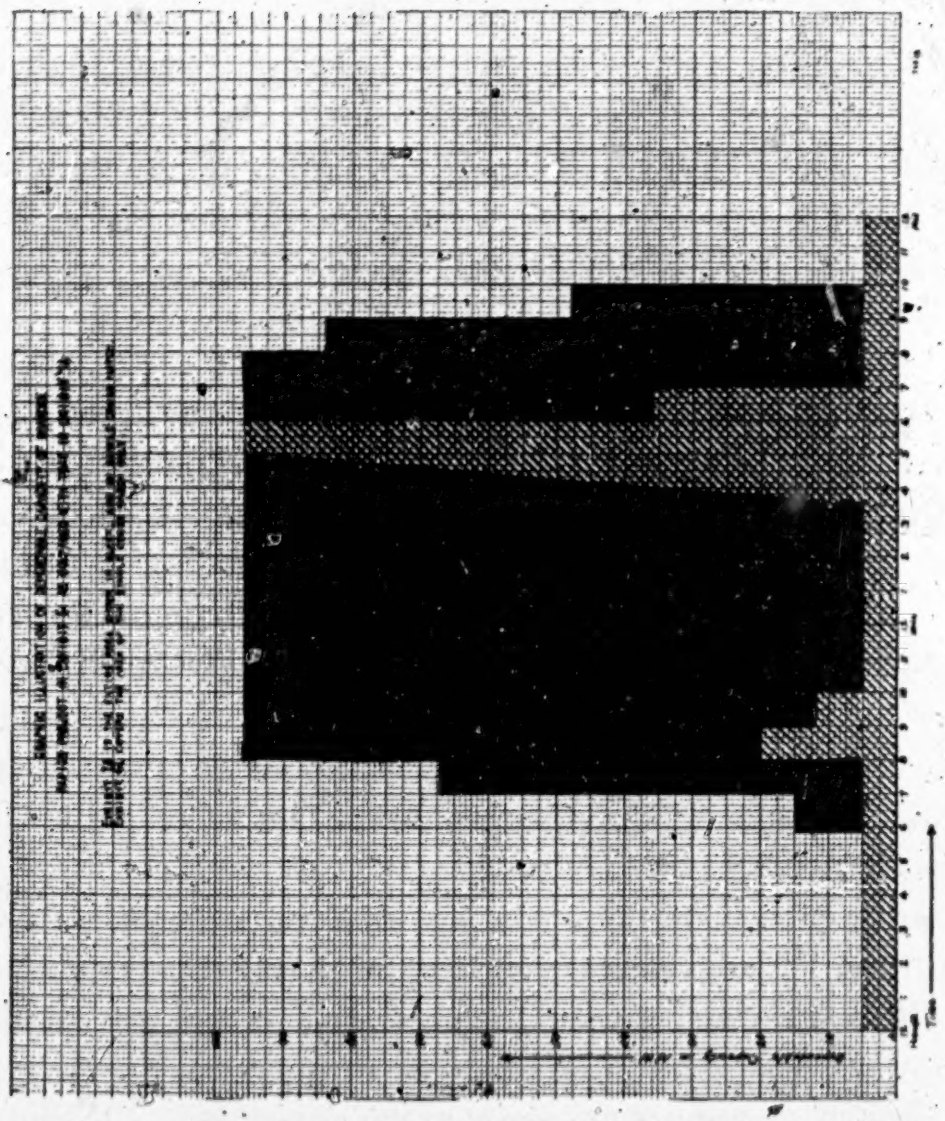
The Secretary's claimed proof (M., 5; S. R. B., 26–8) has scaled his computed required operation from the chart in Exhibit 74 which gives only the estimated actual operation. That can prove nothing because Exhibit 74 contains nothing to show requirements for dependable capacity. Such requirements are found in Exhibit 61. If the Secretary can not understand the difference, reopening is not justified for his education.

In the second place, use of the assumptions the Secretary invokes in his asserted proofs (S. R. B., 26) and use of the flow data which he there tabulates demonstrate, precisely to the reverse of the Secretary's contention with the flows given by the Secretary

without Buggs Island (S. R. B., 26), and with the uncontested and unquestioned required operation for 91,000 kw. of capacity [5561] dependable upon the applicant's system load as shown in Exhibit 61, the dependable capacity is in fact the full 91,000 kw. It is, indeed, shown as 96,000 kw. with the capacity improvement which the project will afford to the present downstream Roanoke Rapids plant. The Secretary, or certainly his engineers, can carry out the details of this computation which manifests from the record unquestioned demonstration of a generous margin of flow to provide the full 91,000 kw. capacity. Reopening is not justified for mathematical computation of a manifest conclusion from the record.

The Secretary has thus used Exhibit 74 to support an assertion where Exhibit 74 contains no data to support it, whereas he has failed to use Exhibit 61 which establishes the precise reverse of the assertion. The Secretary's errors are not after discovered evidence calling for reopening of the case.

* * * * *

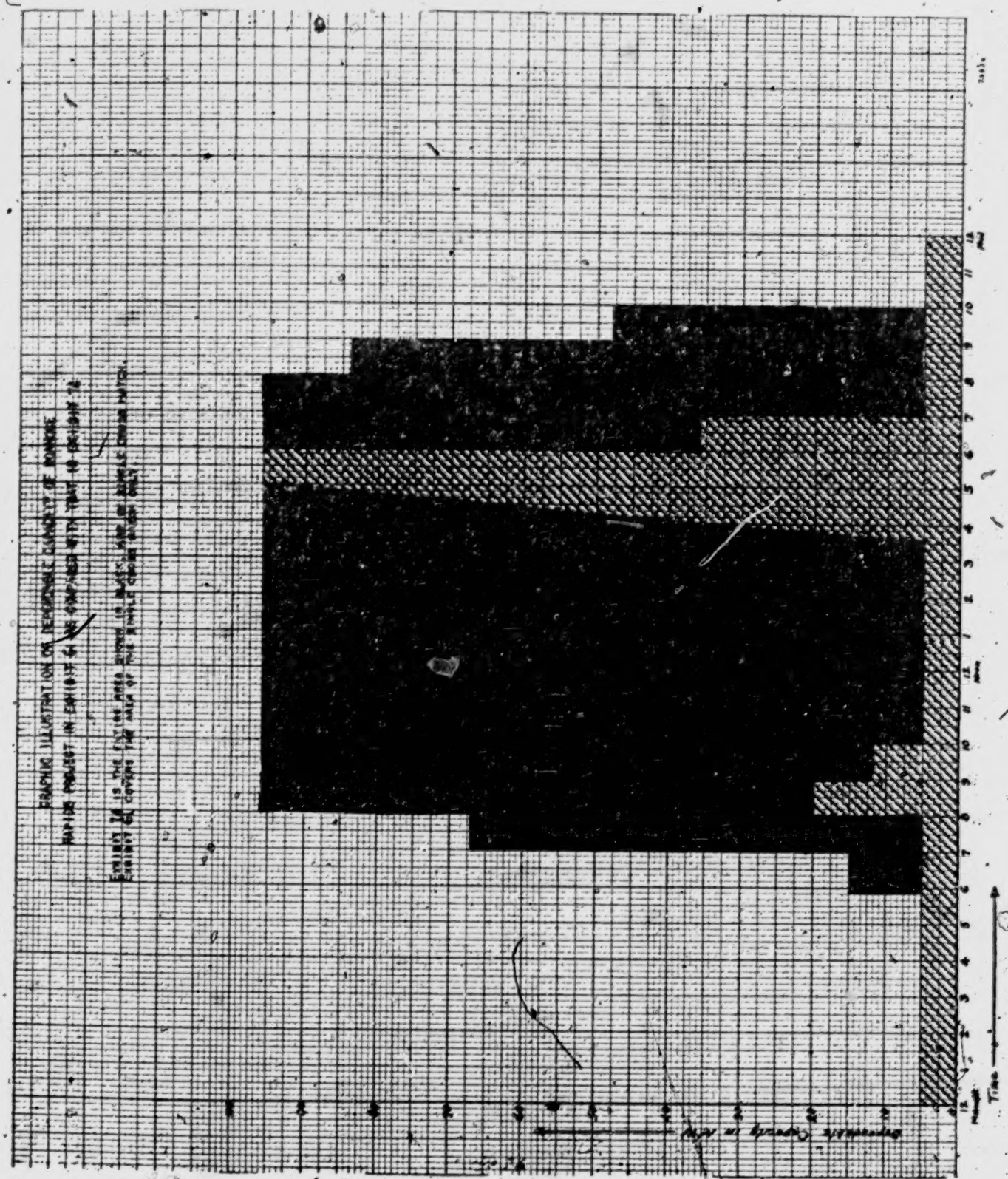


TESTIMONY OF MR. HAMILTON

DIRECT EXAMINATION

[2872] Q. Can you state now the extent to which the proposed Roanoke Rapids project would be economically infeasible without Buggs Island.

A. Yes. The answer is that the feasibility is reduced by $1,955,000 as compared with the feasibility of the proposed project with Buggs Island. If we



TESTIMONY OF MR. HAMILTON

DIRECT EXAMINATION

take the figure of $326,000 as the amount by which Roanoke Rapids with Buggs Island is feasible, then the project without Buggs Island is infeasible by about $1,630,000. The question, however, is academic, because without Buggs Island the Roanoke Rapids project lacks dependability and would not be constructed.

Q. If, as you say, the annual benefit to Roanoke Rapids is $1,955,000, why did you testify that the minimum headwater benefit payments should be only $690,000 per year?

A. Because I was acting under instruction of counsel as to what Section 10 (f) of the Federal Power Act provides; namely, that the headwater benefit payments should cover an equitable part of the annual charges for interest, maintenance and depreciation. Even there I limited my computation to only [2873] a part of the reservoir.

Q. Mr. Hamilton, you say that in order to determine these benefits you compared the operation of Roanoke Rapids with Buggs Island on the one hand, with the operation of Roanoke Rapids without Buggs Island on the other, along parallel patterns. Do you know whether Exhibit 61 was introduced by the applicant for the purpose of showing how Roanoke Rapids would be operated without Buggs Island?

[2874] A. I gather from reading the applicant's opposition to the Secretary's motion to reopen the proceeding that Exhibit 61 represents the applicant's operation of Roanoke Rapids without Buggs Island.

Q. Does Exhibit 61 assume a pattern parallel to that shown in Exhibit 74?

A. It does not.

Q. Have you prepared an exhibit showing a comparison between the pattern of operations in Exhibit 61 and Exhibit 74?

A. I have. It is Exhibit 82, giving a graphic illustration of the pattern in Exhibit 61 superimposed on the pattern in Exhibit 74 for Thursday in December.

Q. Are these two patterns drawn to the same scale?

A. They are.

Q. Will you please explain this Exhibit with reference to the production of power and use of the plant investment?

A. In Exhibit 74 you will note that the plant is operated on the peak for 12 hours a day, while in Exhibit 61 the plant is operated on the peak for only 1 hour a day. It is very evident that a plant that has availability for 12 hours peak operation is of considerably greater value than a plant which is available for only 1 hour's operation.

In the case of pattern shown on Exhibit 74, additional capacity would not have to be supplied in the future to take care of 12 hours of peaking, while in the pattern shown on [2875] Exhibit 61 if the plant was only good for one hour of peaking additional investment would have to be employed to take care of more than one hour of peaking.

Q. If you needed that amount of power on peak for 12 hours a day, does that mean that you would construct 11 additional plants, each involving an in-

vestment of some $27,000,000, to take care of your peaking needs?

A. No; I would not. To my mind that would be absurd. Even if the question were whether one additional plant should be built so as to take care of two hours of peaking, it would be absurd to do so.

Q. Isn't that what the applicant's proposal amounts to, when it presents Exhibit 61 as its pattern of operations without Buggs Island?

A. That is correct.

Q. Is there any way of equating the value of capacity with the plant operating according to the pattern shown in Exhibit 61, as compared with the value of the capacity with the plant operating in accordance with the pattern in Exhibit 74?

A. A rough way of equating the two would be to say that the dependable capacity obtained in Exhibit 61 would be worth about one-twelfth the dependable capacity shown in Exhibit 74. Mathematically, it could be stated that Exhibit 61 requires a hydro project with a flow of 2,625 c. f. s., while [2876] Exhibit 74 requires a project with a flow of 11,164 c. f. s.

Therefore, one project is 4.2 times more valuable than the other.

However, such calculation would be assigning too high a value to the capacity in Exhibit 61 because a plant that is capable of meeting a load for only one hour on a predesignated day in the month of December for the life of the project has, from a practical point of view, very little, if any, dependable capacity value.

As an illustration, Exhibit 61 shows that as far in the future as December 1953 it was recently estimated that the dependable capacity would be 91,000 kw., and on a Thursday, whereas Form 12 filed by the company with the Federal Power Commission for 1949 shows that the peak in December occurred on Tuesday, not on Thursday.

With all the best plans laid Exhibit 61 without Buggs Island storage represents only a guess as to how Buggs Island will release water or that the rainfall will occur at the right time. It is not a sound engineering plan for securing capacity that must be dependable.

* * * * *

Cross-examination by Mr. MOORE:

[2881] Q. Now, will you turn for a moment to Exhibit 80? I am now referring to Revised Exhibit 80. The column entitled (r) is there entitled "Derived Peak Without Buggs Island" and according to the legend is derived by dividing the average capacity available from the stream flow by 96,000 kw., is it not?

* * * * *

The WITNESS. That's right.

By Mr. MOORE:

Q. Could you turn to Exhibit 87 that was introduced through Mr. Creim?

A. Yes, sir.

Q. If you will look at column (r) on that exhibit that is headed "Related Peak for Roanoke Rapids."

That is derived [2882] in the same way as column (r), Exhibit 80, is it not?

A. Yes, that is right.

Q. Then are we to understand that the column headings, although reading differently, are intended to mean the same thing?

A. Column (k) in 87 includes the average capacity, including 2,650 kw.

Q. I am now talking about column (r).

* * * * *

The WITNESS. I want to go through the calculation and check and make sure that was the answer. What we were striving for, I was, was to get in the final column the kw.-peaking capacity furnished by Buggs Island. These columns and the [2883] headings have been changed from time to time and I am not so sure that Exhibit 87 follows the exact same parallel as Exhibit 79.

By Mr. MOORE:

Q. The answer then is that you don't know, is that right?

A. I don't know without examining into it, checking into it.

Q. You can't tell from your knowledge of the two exhibits?

A. Yes, I can tell, if you want to wait.

* * * * *

The WITNESS. Column 79 is "Related Peak for Roanoke Rapids" and column (r) is "Related Peak for Roanoke Rapids."

By Mr. MOORE:

Q. That is on 87?

A. That is on 87. As far as I can see they are both alike.

Q. That is all I am trying to find out. Do you understand they are intended to mean the same thing?

[2884] A. Yes.

* * * * *

Will you look at Exhibit 81 now for a moment.

* * * * *

By Mr. MOORE:

Q. Will you look at Number 81 now, column (s). That is entitled "Related Peak for Roanoke Rapids." That is derived in the same manner, is it not?

A. Yes, that should be derived in the same manner.

Q. Turn back again for a moment to Exhibit 80, if you will. I call your attention to columns (l), (m) and (n) which read "Weighted Average kw."

A. Yes.

Q. But we note that they have there the same values as columns (m), (n) and (o) on Exhibit 79. Will you now look at Exhibit 79, columns (m), (n) and (o)?

A. All right.

Q. Were they derived in the same way and are the legends intended to be synonymous?

A. Yes.

Q. Mr. Hamilton, did you participate in the preparation [2885] of the data shown on Exhibit 87 introduced through Mr. Creim?

A. I had some participation in it, yes, sir.

Q. To what extent?

A. Well, I had made out under my direction these exhibits and then I also went further and made a

lot of study on other stream flow conditions, not only these but other conditions of stream flow.

Q. Did you not do the primary work that produced Exhibit 87?

A. No, I wouldn't say that, no, sir. The Southeastern staff was working on this for possibly several weeks before I got to Washington. I have just been in Washington recently. I have been out of the country.

Q. Did you consider you were working under Mr. Creim's direction in the work that you did on that Exhibit 87?

A. No, I was not working under him.

Q. Were you working on it at his request?

A. No, he didn't ask me to work on it at all.

* * * * * *

[2886] Q. Mr. Hamilton, are not all of those exhibits of yours, 79, 80, 81 and 82 based on your assumption that in order to be dependable on the load of the applicant, Virginia Electric and Power Company, for its full capacity of 91,000 kw., the Roanoke Rapids project must operate as indicated on that Exhibit 74?

A. Well, it is my understanding that that is what Mr. Cary testified to and that is the proposed schedule which they would like to operate under.

Q. The answer to my question is yes, isn't it?

A. Yes.

* * * * * *

[2887] By Mr. GIBSON:

Q. The question by Mr. Hankin was:

Do you know whether Exhibit 61 was introduced by the applicant for the purpose of

showing how Roanoke Rapids would be operated without Buggs Island?

And your answer here is:

> I gather from reading the applicant's opposition [2888] to the Secretary's motion to reopen the proceeding that Exhibit 61 represents the applicant's operation of Roanoke Rapids without Buggs Island.

A. Yes, I had that in mind and I also had it in mind that I heard testimony where it was set forth that the project could be operated one hour a week or would be operated one hour a week at 96,000 kw., and that the applicant could secure 96,000 on one day's operation.

Q. I turn to the applicant's objection to reopening the proceedings at page 13 and ask you if you arrived at your conclusion that Exhibit 61 represented the applicant's operation of Roanoke Rapids without Buggs Island from this statement:

> It is found in Exhibit 61——

I am reading from our objection.

> It is found in Exhibit 61 which shows the operation which is required, regardless of whether Buggs Island is or is not in existence, in order to provide 91,000 kilowatts of capacity dependable upon the applicant's system load.

Did you arrive at your conclusion from that statement in the objection?

* * * * * *

Mr. GIBSON. I was also going to call his attention to [2889] one further statement. It reads as follows:

> Exhibit 74 contains nothing to show requirements for dependable capacity. Such requirements are found in Exhibit 61.

By Mr. GIBSON:

Q. Did you, from either of those statements, make your conclusion that Exhibit 61 shows how we operate Roanoke Rapids without Buggs Island?

A. Well, in 61 according to this you set it out without Buggs Island in existence and in order to provide 91,000 kw. of capacity dependable upon the applicant's system load. It is from that that I arrived at my conclusion, as well as the testimony to the effect that if the project was operated for only one hour to meet a load curve requiring 91,000 kilowatts for one hour, that would constitute dependable capacity.

To my mind that is not so. I think that is just a burlesque on the definition of dependable capacity.

Q. You do understand, do you not, that Exhibit 61 affords the measure of energy necessary for the project to carry the company's system load above 624 megawatts in the week of annual peak load in December 1953?

* * * * * *

The WITNESS. I don't know whether that will do that or not. [2890] It set forth that it would do that.

By Mr. GIBSON:

Q. Is there anything in your Exhibits 79, 80, and 81 showing that it would not do that?

A. No. If you have full storage it is possible to so regulate the storage with the natural releases that you would get possibly 96,000 kilowatts for one hour on each of the days in December. However, to my mind no one would wish to spend $27,000,000 to get four hours of capacity in the month of December.

Q. I understand that. I have heard your views but you gave me quite an explanation in answer to a question which was a question calling for a yes or no answer.

* * * * *

[2891] The WITNESS. I cannot make a positive statement until I study these exhibits to see if there would be enough water on certain days, as covered by these exhibits, to permit of meeting the load pattern on 61.

* * * * *

[2893] The WITNESS. Mr. Examiner, I have made a couple of checks on that last answer that I could change, if you want me to.

* * * * *

On Exhibit 80 there are a number of days in there where we do not have sufficient storage and second feet flow to equal 2625 second-feet days that would be required to meet the pattern. That is also true on Exhibit 81. There are a number of days beginning with the 26th, 27th.

By Mr. GIBSON:

Q. But the exhibits or your exhibits do not compute whether the pondage at Roanoke Rapids can be used

to take care [2894] of those days for purposes of Exhibit 61, do they?

A. No. The exhibit shows how we would operate to conform to the pattern.

Q. Of Exhibit 74?

A. Of Exhibit 74, one conforming to the pattern and the other without any attempt to conform to the pattern.

* * * * *

[2900] Q. Would you mind taking Exhibit 79, please, Mr. Hamilton? Before I ask you some questions about that I would like to get one thing clear upon which I am still a little mixed up. On Exhibit 80, columns (l), (m) and (n), you use the words, "Weighted Average kw. Capacity." On Exhibit 79 you use the words "Average kw. Capacity." Is there some difference between the two exhibits?

A. No, there is not meant to be any difference.

Q. On Exhibit 79 I understand Mr. Moore went into this but I certainly did not get a clear understanding from the colloquy at that time and if you will just be patient I would like to ask one further comparison.

On Exhibit 79 column (r) states that, "It is the related peak for Roanoke Rapids." Exhibit 80 says that column (r) is the "Derived peak without Buggs Island." Are those two columns supposed to be comparable?

A. I think I answered "yes" this morning on that.

[2901] Q. Are they the same thing?

A. Yes; they are the same thing.

Q. If you replied before I missed it and I am sorry to bother you about it.

Now returning to Exhibit 79. Are the data in column (l) in Exhibit 79 inclusive of data in columns (e) and (g) of the same day?

Mr. HANKIN. Do you understand the question?

The WITNESS. What is that?

By Mr. GATCHELL:

Q. Are they inclusive of the data in columns (e) and (g) of the same day?

A. They have nothing to do with (e) and (g).

Q. Column (l)?

A. Column (l), no. That is the amount of water that would be required to meet the pattern in excess of 2,650 kilowatts.

Q. That's right, and column (e) is the minimum flow required which generates 13,200 kw., and column (g) is the flow used for capacity in excess of 13,200?

A. Yes.

[2902] Q. You say they have no relation to one another?

A. No. Columns (l), (m), and (n) have to deal with load pattern 74. The columns to the left have to deal with the releases of water of 4,310 second-feet, the releases being proportioned to the amount of water in pattern 74.

Q. You used the term "dependable capacity" of the Roanoke plant under several circumstances. What do you mean by "dependable capacity," as you have used it in your testimony?

A. When we talk of dependable capacity, we are in reality talking about the dependable capability of the plant. We have before us the applicant's

Exhibit 74, which shows how they propose to operate the project. Therefore, Exhibit 74 must represent not only dependable capacity, but dependable capability.

Q. And by dependable capability, you mean what it could do?

A. Dependable capability is what the plant is capable of doing.

Q. What is the difference between that and dependable capacity? Apparently, there is some difference that has escaped me.

* * * * * *

[2903] A. We may have a steam station and the load dispatcher, because he is only using 50,000 kilowatts of that station, may say that that station has 50,000 kw. dependable capacity, yet the load dispatcher knows that he has 100,000 of dependable capability in that station.

Q. Is that the differentiation you have made in your presentation here?

A. In a valuation of a project, yes. I might clarify it somewhat by referring to the definition appearing in the glossary here.

Q. You are now examining the glossary prepared by the Federal Inter-Agency River Basin Committee?

A. Yes.

Q. Published in 1949?

A. It says in there, Article 44, "The load carrying ability for the time interval and period specified, when related to the characteristics of the load to be supplied."

Now, it comes to what we are really dealing with: "Dependable capacity of a station is determined by such factors as capability, operating power factor and portion of the load which the station is to supply."

Now, I will call your attention to the article under "Foreword," page III: "An attempt has been made to set up the definitions and abbreviations according to the most [2904] commonly accepted uses of the term."

Further down, in the next to the last paragraph, it says: "No attempt has been made to reconcile the specialized and in some cases complicated uses of terms in this Act. No legal application or connotation of any of the terms is to be understood from its inclusion in the glossary nor from the use of the glossary by anyone."

Q. You are not in disagreement with those statements, are you?

A. I am in disagreement of the application of those statements to the customer's application in setting forth dependable capacity.

Q. By that, you mean that you accept those statements and the definitions, but do not regard the definition as applicable to the term "dependable capacity" as defined by the applicant?

A. When you come to apply that definition to one hour's use, then I say that is a burlesque on the definition.

Q. But you are not quarreling with the definition?

A. No.

Q. In your Exhibit 79, how much usable drawdown did you estimate would be available at the Roanoke Rapids pool?

A. 5,000 second-feet days.

Q. Where did you get that figure?

A. That was discussed in the hearings that I attended, [2905] and in the—I don't know whether that appears in 29, or not.

Q. Yes. If I may help you, Mr. Hamilton, turn to page 5. There is a long paragraph ending at the top of the page, and about eight lines from the bottom there is a sentence which reads: "The top three feet of the pond contains about 172,000 c. f. s. hours." Do you see that?

A. Yes.

Q. You divide 172,000 by 24—I can do that in my head—it ought to give you something over 7,000, should it not?

A. Yes. It is my recollection that there is further testimony that reduced this amount as set up here in the Charles T. Main report.

Q. Do you have a reference to that further testimony?

A. No; I do not have.

* * * * *

The WITNESS. I will furnish it, if it is feasible for me to find it.

* * * * *

[2923] Q. Will you turn to Exhibit 80, please?

A. Yes, sir.

Q. As I look at Exhibit 80, column (b) shows that the first line is 1,420, the second line is 5,000, and the next line is zero.

A. Yes.

Q. Why was that pondage drawn down for the purposes of your study as soon as possible?

A. This was to show that if we operated Roanoke Rapids to try and conform to pattern 74, how long we could go before running out of water. You will see from that, we couldn't go very far before we ran into trouble.

Q. Do you follow the pattern after you draw your reservoir down?

A. No. We started off trying to follow a pattern.

Q. Did you make any effort to regulate the pondage as shown in column (b) so as to even out the available flow as shown in column (d)?

A. No. In Exhibit 81, we applied a pattern in that [2924] exhibit to see how far we would get if we applied a pattern.

Mr. HANKIN. You mean a parallel pattern?

The WITNESS. Parallel pattern.

By Mr. GATCHELL:

Q. After your pondage was exhausted, as shown in column (b) on Exhibit 80, what did you follow in determining your parallel operation?

A. We started off to see if we could follow the pattern. We could not have followed the pattern.

Q. What did you follow after that?

A. We made use of what water we have to see where we came out.

Q. Couldn't you have followed that pattern initially?

A. The objective of the exhibit is to show that we tried to follow pattern Exhibit 74 and use the second-feet of water required in 74, and that we would run out of water.

Q. You found you couldn't do it, so you abandoned the pattern. Why could you have not abandoned the pattern of Exhibit 74 on the first day?

A. Because we were going to present another exhibit, No. 81, to show that if we did have a pattern, we couldn't get by.

Q. Did you have any basis for assuming that the portion of the Roanoke Rapids output which is shown in column (h) would be used 16 hours a day on weekdays and 6 hours on [2925] Saturday?

A. Yes; from Exhibit 74.

Q. And that's all?

A. That's all.

* * * * *

[2933] Q. Will you turn again to Exhibit 80, please?

A. Yes, sir.

Q. On Exhibit 80, would you just take a look at column (h), "Average kw. Capacity, 24 Hours in Excess of 2,650." Could that power supply shown in column (h) be used only during the [2934] peak hours by VEPCO?

A. Yes.

Q. Could it be used during other hours?

A. It could be used at any time they saw fit to use it.

Q. For the purpose of your study, it could be used at any time?

A. No. In this study here, we set it up so that it would be used in 16 hours in accordance with pattern 74.

Q. Other than your studies, could it be used at any time, the power shown in column (h)?

* * * * *

The WITNESS. There is no reason why the operator of Roanoke Rapids couldn't use that energy at any time.

By Mr. GATCHELL:

Q. On Exhibit 80, would you take a look at column (k)? Do the flows shown in column (k) conform to the releases that would be required from Buggs Island Reservoir to supply the customers to be served from the Buggs Island project by the Southeastern Power Administration?

* * * * *

[2935] The WITNESS. Item (k) is the amount of water that would be required on a Monday to comply with the requirements of Exhibit 74.

By Mr. GATCHELL:

Q. My question is: Do the flows shown in column (k) conform to the releases that would be required from the Buggs Island Reservoir to supply the customers to be served from the Buggs Island project by the Southeastern Power Administration? I think the answer to that would be Yes or No.

* * * * *

[2936] The WITNESS. No.

By Mr. GATCHELL:

Q. Have you made a reservoir operational study for the Buggs Island project in connection with the figures shown in column (k) on Exhibit 80?

A. Yes, I have, to a certain extent. The water in column (k) in each case would be 500 second-feet in excess of the figures shown. This would mean that on a Thursday, 10,498 second-feet being shown, to which 500 more would be added; I then compared that with my exhibit of the 74 pattern.

Q. You mean Exhibit 74?

A. Exhibit 74. That would require 11,164 second-feet a day for the Thursday.

I therefore found that we would not have 11,164 c. f. s. on Thursday.

Q. What happened then? What did you do with it when you found out?

A. If we didn't have the flow?

Q. What happened after you made the discovery that you would not have 11,164 c. f. s. on Thursday? What happened then?

A. That resulted in a shortage of dependable capacity.

Q. Did you have that water available at Buggs Island?

A. No; in December, no. Some months, we would.

[2937] Q. Have you made a month-by-month study of the loads to be served from the Buggs Island project by the Southeastern Power Administration in connection with the figures shown in column (k) on Exhibit 80?

A. No; I have not.

Q. What releases in addition to those shown in column (k) of Exhibit 80 would be required to supply the customers to be served from the Buggs Island project in accordance with any plans of the Southeastern Power Administration?

A. I have not made any study of what waters would be released from Buggs Island to meet the load requirements of the Southeastern Power Administration.

* * * * *

Q. Will you finish your answer, Mr. Hamilton?

A. My studies were to show, if the 4,310 second-feet [2938] was the water available, that the pattern couldn't be met.

My studies are also to show what would happen if we tried to meet pattern 74 without a parallel pattern.

My studies further went to show what would happen if you tried to meet pattern 74 with a pattern that was parallel but in accordance with a ratio of the water available to the water required to supply the pattern.

* * * * *

[2940] By Mr. GATCHELL:

Q. As I understand Exhibit 80, Mr. Hamilton, it shows that the water available, as set out in column (c), was insufficient to meet the load pattern of Exhibit 74, and the pond had to be drawn down right after the second day shown on here, which is 3 M; is that right?

A. That is correct.

Q. And column (c) shows the average daily flow as reported by the U. S. G. S. water-supply papers?

A. That is correct.

Q. Are the figures in column (c) on Exhibit 80 the same as those on Exhibit 81 in column (c)?

A. Yes; they are the same, the same flows.

Q. Does column (f) on Exhibit 80 correspond to column (g) on Exhibit 81?

A. Yes; that's right.

[2941] Q. As I examine column (g) on Exhibit 81, it shows that with the exception of the first day where you have zero—May I start that again, Mr. Hamilton?

A. Surely.

Q. As I look at column (g) on Exhibit 81, it shows that with the exception of the first day, where zero flow is reported, that there was more than a sufficient supply of water to meet the load pattern of Exhibit 74, from the second day through the ninth day, or down to 11 T; is that correct?

A. Down to what day?

Q. 11 T, as in "Tom."

A. Yes; I think there is enough water available.

Q. Now, according to footnote 4, there was not sufficient flow for a number of days right after that to meet the load pattern of Exhibit 74; is that right?

A. That is correct.

Q. Does that mean that on the days shown in column (g), Exhibit 81, and not marked by footnote 4, there was insufficient flow or more flow than to meet the load pattern on Exhibit 74?

A. Those that are numbered did not meet the load pattern.

Q. On Exhibit 74?

A. Right.

Q. And those that are not marked by footnote 4 did meet the load pattern?

[2942] A. Yes.

Q. Yet, as I examine Exhibit 80, which you say has the same daily average flow figures in column (c) as those appearing in column (c) on Exhibit 81, I look at 80 and you say you do not have sufficient flow to meet the load pattern of Exhibit 74; is that right? Have I misinterpreted these two exhibits?

* * * * *

The WITNESS. On 80 you do not have sufficient water to meet the load pattern, if you started out in the first of the month and tried to operate strictly in accordance with pattern 74.

By Mr. GATCHELL:

Q. Would you turn, on Exhibit 81, to column (1)? Have you made an hour by hour study for each day shown on Exhibit 81 for the purposes of data in column (1), to determine how much water would be let down during each hour of the day from Buggs Island to supply that hourly load shown on Exhibit 74?

A. I have.

Q. You did make that study?

A. Yes.

Q. How much time did you allow for travel time of releases from Buggs Island to Roanoke Rapids?

A. The travel time is approximately eight hours. I [2943] made no allowances for travel time.

Q. Was the use of pondage in column (b) based on a specific pattern of operations for that column? That is Exhibit 81 I am speaking of.

A. How is that?

Q. Was the data shown in column (b) on Exhibit 81, which is the storage at the beginning of that day in c. f. s. days, was that based on a specific pattern of operations? That column, Mr. Hamilton, is the one I want.

A. That was based on trying to conform to a ratio.

Q. What is the ratio?

A. The ratio was .244.

Q. And that is the one that appears in footnote 2?

A. That's right.

Q. Which was not referred to in column (b).

How did you determine for column (g) the amount of water that was assumed to be used for capacity?

A. The amount that we assumed to be used was the water that was available in the month, minus the low flow, divided by the amount required to meet pattern 74, minus its low flow requirements.

Q. Did you prepare data comparable to that shown in column (j) on Exhibit 81, but assuming a pattern of operations as shown in Exhibit 61?

A. 61 has nothing to do with this.

[2944] Q. You did not prepare such a computation for following the load pattern of Exhibit 61?

A. I show 61 in Exhibit 82 for a Thursday.

Q. That is shown on Exhibit 82?

A. That is shown on Exhibit 82.

Q. But there is nothing on Exhibit 81 that relates in any way to Exhibit 61?

A. No.

Q. And you did not prepare data similar to or comparable to the data shown in column (j) of Exhibit 81, taking the load pattern shown in Exhibit 61?

A. No, I did not, because I do not think that 61 is at all realistic.

Q. Do the figures in column (1)—let me change that. First, let me ask you this question:

Does column (1) on Exhibit 81 show average releases on a daily basis?

A. That shows what the pattern would require on a daily basis. In other words, that much water should arrive at the Roanoke Rapids project to conform to or satisfy 74.

Q. That is on a daily basis?

A. Yes.

Q. You haven't shown here anything as to when it will arrive?

A. No.

[2945] Q. Would you take Exhibit No. 82, please. Would you read from that graph the dependable capacity that would be obtained following the pattern of Exhibit 61, if the energy requirements are met?

* * * * *

The WITNESS. This graph is to show that 61 is within about one-twelfth of meeting the operating pattern proposed by the applicant and known as Exhibit 74.

* * * * *

Q. Can you read from that graph, and if you can, will you, please, will you read the dependable capacity that would be obtained from Exhibit 61 if the energy requirements are met?

A. What do you mean by "if the energy requirements are met"?

Q. The energy requirements of Exhibit 61. Doesn't Exhibit 61 show any energy requirements at all?

A. As I understand your question——

Q. It shows kilowatts in hours. What is that?

A. As I understand your question, if we had sufficient water or energy——

Q. I don't believe I mentioned water at all, Mr. Hamilton.

[2946] A. Water is energy, in this case.

Q. Well, all right, sir.

A. Whether the pattern as shown here for 61 could be met? That is purely an academic question, and my answer is Yes, academically so speaking.

Q. Yes what? I asked you if you could read the dependable capacity that would be obtained from Exhibit 61 if the energy requirements shown on this exhibit are met.

* * * * *

[2947] The WITNESS. No. Academically, Yes, but we don't know what he refers to when he refers to the dependable capacity. It might be just some dream; I don't know. But, speaking about dependable capacity as I would view it for an expenditure of 27 millions of dollars, my answer is certainly No.

* * * * *

By Mr. GATCHELL:

Q. I read from the title of Exhibit 82, Mr. Hamilton: "Graphic Illustration of Dependable Capacity of Roanoke Rapids Project in Exhibit 61 as Compared With that in Exhibit 74." I am merely taking your exhibit, your words, and asking you to read from that exhibit the dependable capacity from Exhibit 61. Can you do that? Will you do it from your exhibit? I don't know how you used "dependable capacity." That appears in your [2948] exhibit in the title. Whatever way you used it is all right with me.

A. All I have done here is place on this sheet the amount of dependable capacity that the applicant sets forth that he needs, and as set forth by 61.

* * * * *

By Mr. GATCHELL:

Q. Is the heading in error? Am I misinterpreting the heading?

A. You can make several interpretations of it. I think you are misinterpreting when you want to have me set forth what is shown here in reality as the dependable capacity. I could never say that this 96,000 kw. here of dependable capacity as shown by the applicant is what I would consider dependable capacity on which an investment of $27,000,000 could be made.

* * * * *

[2951] By Mr. GATCHELL:

Q. Now, Mr. Hamilton, are Exhibits 61 and 74, as shown in Exhibit 82, parts of the same load curve, if you know?

A. No; they couldn't be parts of the same load curve. They could, but the possibilities are that they are not.

Q. Do Exhibits 61 and 74, as shown in Exhibit 82, [2952] apply to the loads of the Virginia Electric and Power Company, if you know?

A. I do not know on what load the applicant contemplates to run Exhibit 74. All I know is that he has presented Exhibit 74 as the manner in which he proposes to operate Roanoke Rapids.

Q. Is any part of your testimony in this proceeding, at this time, predicated upon load studies of the loads which could be served by the Buggs Island plant?

A. No.

Q. Reading over your testimony as to the distinction in your use of the terms "Dependable capacity" and "dependable capability," I have been in some difficulty. You had yesterday a glossary that had been prepared by the Federal Inter-Agency River Basin Committee, and from that you read a definition of dependable capacity. Would you mind reading us the definition of dependable capability?

* * * * *

The WITNESS. Here is the word "capability": "The maximum load which the machine, apparatus, station, or system can carry under specified conditions for a given time interval."

By Mr. GATCHELL:

Q. What is the definition of "dependable capability"?

[2953] Mr. HANKIN. Is there such a definition, Mr. Gatchell?

The WITNESS. I just read the one under the caption "capability."

By Mr. GATCHELL:

Q. Does that, Mr. Hamilton, say "dependable capability," or does that define the term "capability"?

* * * * *

[2954] The WITNESS. You are asking me if I can find a definition in here under the caption "dependable capability"?

By Mr. GATCHELL:

Q. Yes, sir. You used the term yesterday and made a distinction. I want you to give us the definition from that glossary of "dependable capability."

A. I can't find that for the caption "dependable capability," but I find the one under the caption "capability," which is dependable capability.

* * * * *

[2957] Redirect examination by Mr. HANKIN:

Q. Mr. Hamilton, you were asked with reference to page 5 of Exhibit 29, whether the storage capacity was some 7,000 c. f. s. days, or 5,000 c. f. s. days. Do you have any further answer to this question?

A. The area of the pond is 4,900 acres. If we operate at a draw-down of 2 feet, we approximate 5,000 c. f. s. days. Mr. Strandberg was asked about dropping the reservoir down to 3 feet, which would be necessary to secure approximately 7,000 c. f. s. days. Mr. Strandberg's testimony was to the effect

that it could be done, but if it was done, it would be at the sacrifice of efficiency and possibly result in cavitation of the wheels.

Consequently, I concluded that 5,000 c. f. s. days was a reasonable amount of storage in the Roanoke Rapids pond, instead of a higher figure.

* * * * *

[2958] Q. Mr. Gatchell asked you whether the figure of 2,500 c. f. s. in column (e) of Exhibit 79 was the minimum continuous flow that would be required over a period of 24 hours, or whether it represents an average minimum flow for the day. Will you please clarify the answer you gave?

A. If the navigation requirements are 2,500 c. f. s., it means that at least 2,500 c. f. s. will have to be passed by the Roanoke Rapids project around the clock on every day.

Q. You heard Mr. Creim testify concerning the fact that the applicant's project, if operated according to the pattern in Exhibit 74, would not have a dependable capacity of 91,000 kw. If I asked you this question, would you give the same answer?

A. Yes.

Q. And if I asked you why you used Exhibit 74 as the basis of your comparison, rather than Exhibit 61, would your answers be in accord with those given by Mr. Creim?

* * * * *

The WITNESS. They would be.

(781)

VIRGINIA ELECTRIC AND POWER COMPANY

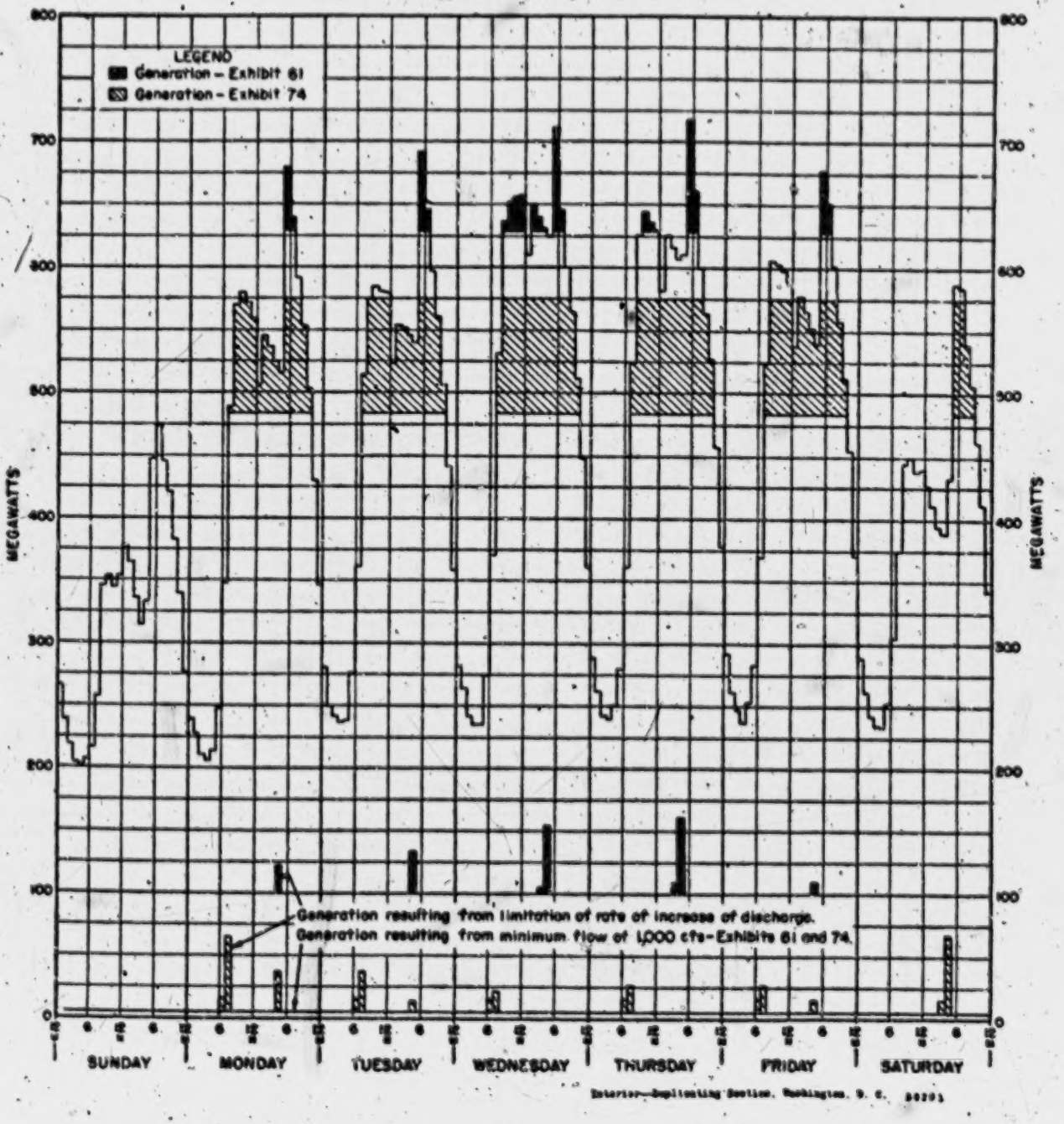
ESTIMATED WEEKLY LOAD CURVE

WEEK OF ANNUAL PEAK - DECEMBER 1953

Syst. Op. Dept. March 4, 1949

FEDERAL POWER COMMISSION
Docket No. Proj. 2009
Hearing Ex. No. 82
Date Identified June 15, 1950
Date Admitted June 15, 1950

Relative location of energy and capacity on Exhibit 61 with energy and capacity on Exhibit 74



Interior—Duplicating Section, Washington, D. C. 80791

Exhibit 80A

Average daily capacity furnished by Buggs Island during a critical December month (Dec. 2, 1917–Jan. 1, 1918) [1] *(with usable storage of 7,166 c. f. s.-days)*

(a) Date and day	(b) Storage beginning day c. f. s.-days (see end of previous day)	(c) Average daily flow c. f. s.[2]	(d) Total available c. f. s. (b)÷(c)	(e) Minimum flow—used in generating 2,650 kw.[3]	(f) C. f. s. used to generate in excess of 2,650 kw. from (k), (d) or (c)	(g) Storage at the end of day c. f. s.-days from (d)−(e)−(f)	(h) Average kw. capacity 24 hours in excess of 2,650 (f)×5.3	(i) Average kw. capacity in excess of 2,650[4]	(j) Average kw. capacity including 2,650 kw. (i)+2,650 kw.	(k) C. f. s. releases required for load pattern exhibit 74 in excess of 2,650 kw.	(l) Weighted average kw. capacity required to meet load pattern exhibit 74 in excess of 2,650 (k)×5.3	(m) Weighted average kw. capacity in excess of 2,650 required by exhibit 74[4]	(n) Weighted average kw. capacity required for load pattern exhibit 74 including 2,650[4] (m)+2,650	(o) Average capacity contributed by Buggs Island and existing plant[4] (n)−(j)	(p) Net average kw. contributed by Buggs Island less 5,000 kw. furnished by existing plant	(q) Load factor—pattern exhibit 74	(r) Derived peak without Buggs Island (j)÷(q)	(s) Peaking capacity furnished from Buggs Island after deducting 5,000 kw. for existing plant 91,000−(r)
December																		
2 S	3,586	4,080	7,666	500		7,166			2,650				2,650					
3 M	7,166	3,740	10,906	500	8,245	2,161	43,698	65,547	68,197	8,245	43,698	65,547	68,197			0.710	96,100	
4 T	2,161	6,620	8,781	500	8,281		43,889	65,833	68,483	8,960	47,488	71,232	73,882	5,399	399	.770	88,900	2,102
5 W		5,870	5,870	500	5,370		28,461	42,691	45,341	10,380	55,014	82,521	85,171	39,830	34,830	.887	51,100	39,900
6 T		3,410	3,410	500	2,910		15,423	23,134	25,784	10,498	55,639	83,458	86,108	60,324	55,324	.897	28,700	62,300
7 F		3,090	3,090	500	2,590		13,727	20,590	23,240	9,280	49,184	73,776	76,426	53,006	48,006	.796	29,200	61,800
8 S		3,410	3,410	500	2,720	190	14,416	57,664	60,314	2,720	14,416	57,664	60,314			.628	96,000	
9 S	190	1,620	1,810	500		1,310			2,650				2,650					
10 M	1,310	1,620	2,930	500	2,430		12,900	19,300	21,950	8,245	43,698	65,547	68,197	46,247	41,247	.710	30,900	60,100
11 T		1,370	1,370	500	870		4,637	6,955	9,605	8,960	47,488	71,232	73,882	64,277	59,277	.770	12,500	78,500
12 W		1,250	1,250	500	750		3,975	5,962	8,612	10,380	55,014	82,521	85,171	76,559	71,559	.887	9,700	81,300
13 T		1,370	1,370	500	870		4,637	6,955	9,605	10,498	55,639	83,458	86,108	76,503	71,503	.897	10,700	80,300
14 F		900	900	500	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,320	83,700
15 S		900	900	500	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
16 S		900	900	500		400			2,650				2,650					
17 M	400	900	1,300	500	800		4,240	6,360	9,010	8,245	43,698	65,547	68,197	59,187	54,187	.710	12,700	78,300
18 T		900	900	500	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400
19 W		2,160	2,160	500	1,660		8,798	13,197	15,847	10,380	55,014	82,521	85,171	69,324	64,324	.887	17,900	73,100
20 T		3,090	3,090	500	2,590		13,727	20,590	23,240	10,498	55,639	83,458	86,108	62,868	57,868	.897	25,900	65,100
21 F		3,090	3,090	500	2,590		13,727	20,590	23,240	9,280	49,184	73,776	76,246	53,006	48,006	.796	29,200	61,800
22 S		3,090	3,090	500	2,590		13,727	54,908	57,558	2,720	14,416	57,664	60,314	2,756		.628	91,200	
23 S		1,620	1,620	500		1,120			2,650				2,650					
24 M	1,120	1,370	2,490	500	1,990		10,547	15,820	18,470	8,245	43,698	65,547	68,197	49,727	44,727	.710	26,000	65,000
25 T		1,370	1,370	500		870			2,650				2,650					
26 W	870	1,130	2,000	500	1,500		7,950	11,925	14,575	10,380	55,014	82,521	85,171	70,596	65,596	.837	16,400	74,600
27 T		1,130	1,130	500	630		3,330	4,995	7,645	10,498	55,639	83,458	86,108	78,463	73,463	.897	8,200	82,500
28 F		900	900	500	400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,300	83,700
29 S		900	900	500	400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
30 S		900	900	500		400			2,650				2,650					
31 M	400	900	1,300	500	800		4,240	6,360	9,010	8,245	43,698	65,547	68,197	59,187	54,187	.710	12,700	78,300
January																		
1 T		900	900	500	400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400

[1] Assuming a pattern of operations like that shown on exhibit 74 with required minimum flow of 500 c. f. s.

[2] From U. S. G. S. water supply papers.

[3] F. P. C. decision. (Examiner's Decision p. 81.)

[4] Adjusted to: 16 hours—weekdays, 6 hours—Saturdays.

Exhibit 81A

Capacity of the proposed Roanoke Rapids project with and without Buggs Island during the critical month of December [1] (with usable storage of 7,166 c. f. s.-days)

(a) Date and day	(b) Storage beginning day c. f. s.-days. (See end of previous day)	(c) Average daily flow c. f. s.	(d) Total available c. f. s. (b)+(c)	(e) Minimum flow—used in generating 2,650 kw.	(f) Flow available for capacity in excess of 2,650 kw. (d)−(e)	(g) Flow used for capacity in excess of 2,650 kw. [2]	(h) Storage at end of day c. f. s.-days (f)−(g)	(i) Average kw. capacity in excess of 2,650 kw. 24 hours (g)×5.3	(j) Average kw. capacity in excess of 2,650 [3]	(k) Average kw. capacity including 2,650 [3] (j)+2,650	(l) Release required for load pattern exhibit 74 in excess of 2,650 kw	(m) Average kw. capacity required to meet load pattern exhibit 74 in excess of 2,650 kw. 24 hours (l)×5.3	(n) Average kw. capacity required in excess of 2,650 by load pattern exhibit 74 [3]	(o) Average kw. capacity required for load pattern exhibit 74 including 2,650 [3] (n)+2,650	(p) Average kw. capacity contributed by Buggs Island and existing plant [4] (o)−(k)	(q) Average kw. capacity contributed by Buggs Island less 5,000 kw. from existing plant [5] (p)−5,000	(r) Load factor pattern exhibit 74	(s) Related peak for Roanoke Rapids kw. [3] (k)÷(r)	(t) Kw. peaking capacity furnished by Buggs Island after deducting 5,000 kw. for existing plant [5] 91,000−(s)
December																			
2 S	3,586	4,080	7,666	500	7,166		7,166			2,650				2,650					
3 M	7,166	3,740	10,906	500	10,406	[3] 3,240	7,166	17,200	25,800	28,450	8,245	43,698	65,547	68,197	39,747	34,747	0.710	40,100	50,900
4 T	7,166	6,620	13,786	500	13,286	[3] 6,120	7,166	32,436	48,654	51,304	8,960	47,488	71,232	73,882	22,578	17,578	.770	66,600	24,400
5 W	7,166	5,870	13,036	500	12,536	[3] 5,370	7,166	28,461	42,691	45,341	10,380	55,014	82,521	85,171	39,830	34,830	.887	51,100	39,900
6 T	7,166	3,410	10,576	500	10,076	[3] 2,910	7,166	15,423	23,134	25,784	10,498	55,639	83,458	86,108	60,324	55,324	.897	28,700	62,300
7 F	7,166	3,090	10,256	500	9,756	[3] 2,590	7,166	13,727	20,590	23,240	9,280	49,184	73,776	76,426	53,186	48,186	.796	29,200	61,800
8 S	7,166	3,410	10,576	500	10,076	[3] 2,910	7,166	15,423	61,700	64,350	2,720	14,416	57,664	60,314			.628	96,000	
9 S	7,166	1,620	8,786	500	8,286	[3] 1,120	7,166	5,940		8,590				2,650					
10 M	7,166	1,620	8,786	500	8,286	2,016	6,270	10,685	16,028	18,678	8,245	43,698	65,547	68,197	49,520	44,520	.710	26,300	64,700
11 T	6,270	1,370	7,640	500	7,140	2,191	4,949	11,612	17,418	20,068	8,960	47,488	71,232	73,882	53,814	48,814	.770	26,000	65,000
12 W	4,949	1,250	6,199	500	5,699	2,538	3,161	13,451	20,176	22,826	10,380	55,014	82,521	85,171	62,345	57,345	.887	25,700	65,300

Exhibit 80B

Dependable capacity of proposed project at Roanoke Rapids with the natural stream flow of the month of December 1930, and using minimum release of 500 c. f. s., using the load pattern in exhibit 74, power storage in reservoir 7,166 c. f. s.-days

(a) Month and day	(b) Storage beginning day c. f. s.-days (see end of previous day)	(c) Average daily flow c. f. s.	(d) Total available c. f. s. (b)+(c)	(e) Minimum flow required generates 2,650 kw.	(f) Flow available in excess of 2,650 kw.	(g) Flow used for capacity in excess of 2,650 kw.	(h) Storage at end of day c. f. s.-days	(i) Average kw. capacity in excess of 2,650 kw. 24 hr.	(j) Average capacity in excess of 2,650 kw.[1]	(k) Average kw. capacity including 2,650 kw.[1]	(l) Release required for load pattern exhibit 74 in excess of 2,650 kw.	(m) Average kw. capacity required to meet load pattern exhibit 74 in excess of 2,650 kw. 24 hr.	(n) Average kw. capacity required in excess of 2,650 by load pattern exhibit 74[1]	(o) Average capacity required for load pattern 74+2,650 kw.[1]	(p) Average kw. deficiency at Roanoke Rapids[1] (o)−(k)	(q) Load factor load, pattern 74	(r) Related peak for Roanoke Rapids—kw. (k)÷(q)	(s) Kw. peaking capacity furnished by Buggs Island after deducting 5,000 kw. for existing plant
Nov.																		
30 S	5,936	1,730	7,666	500	7,166		7,166			2,650				2,650				
Dec.																		
1 M	7,166	1,800	8,966	500	8,466	8,245	221	43,698	65,547	68,197	8,245	43,698	65,547	68,197		0.710	96,000	
2 T	221	1,610	1,831	500	1,331	[2] 1,331		7,054	10,581	13,231	8,960	47,488	71,232	73,882	60,651	.770	17,183	73,817
3 W		1,800	1,800	500	1,300	[2] 1,300		6,890	10,335	12,985	10,380	55,014	82,521	85,171	72,186	.887	14,639	76,361
4 T		1,800	1,800	500	1,300	[2] 1,300		6,890	10,335	12,985	10,498	55,639	83,458	86,108	73,123	.897	14,476	*76,524
5 F		1,930	1,930	500	1,430	[2] 1,430		7,579	13,885	16,335	9,280	49,184	73,776	76,426	60,091	.796	20,521	79,479
6 S		2,000	2,000	500	1,500	[2] 1,500		7,950	31,800	34,450	2,720	14,416	57,664	60,314	25,864	.628	41,185	49,815
7 S		2,220	2,220	500	1,720		1,720			2,650				2,650				
8 M	1,720	2,940	4,660	500	4,160	[2] 4,160		22,048	33,072	35,722	8,245	43,698	65,547	68,197	32,475	.710	50,313	40,687
9 T		9,270	9,270	500	8,770	[2] 8,770		46,481	69,721	72,371	8,960	47,488	71,232	73,882	1,511	.770	93,988	
10 W		8,220	8,220	500	7,720	[2] 7,720		40,916	61,374	64,024	10,380	55,014	82,521	85,171	21,147	.887	72,180	18,820
11 T		5,430	5,430	500	4,930	[2] 4,930		26,129	39,193	41,843	10,498	55,639	83,458	86,108	44,265	.897	46,648	44,352
12 F		3,950	3,950	500	3,450	[2] 3,450		18,285	27,427	41,140	9,280	49,184	73,776	76,426	35,286	.796	51,683	39,317
13 S		3,260	3,260	500	2,760	2,720	40	14,416	57,664	60,314	2,720	14,416	57,664	60,314		.628	96,000	
14 S	40	2,980	3,020	500	2,520		2,520			2,650				2,650				
15 M	2,520	2,540	5,060	500	4,560	[2] 4,560		24,168	36,252	38,902	8,245	43,698	65,547	68,197	29,295	.710	54,791	36,209
16 T		2,370	2,370	500	1,870	[2] 1,870		9,911	14,866	17,516	8,930	47,488	71,232	73,882	56,366	.770	22,748	68,252
17 W		2,290	2,290	500	1,790	[2] 1,790		9,487	14,230	16,880	10,380	55,014	82,521	85,171	68,291	.887	19,030	71,970
18 T		2,220	2,220	500	1,720	[2] 1,720		9,116	13,674	16,324	10,498	55,639	83,458	86,108	69,784	.897	18,198	72,802
19 F		2,220	2,220	500	1,720	[2] 1,720		9,116	13,674	16,324	9,240	49,184	73,776	76,426	60,102	.796	20,507	70,493
20 S		2,370	2,370	500	1,870	[2] 1,870		9,911	39,644	42,294	2,720	14,416	57,664	60,314	18,020	.628	67,347	23,653
21 S		2,140	2,140	500	1,640		1,610			2,650				2,650				
22 M	1,640	2,370	4,010	500	3,510	[2] 3,510		18,633	27,904	30,554	8,245	43,698	65,547	68,197	37,643	.710	43,033	47,937
23 T		2,890	2,890	500	2,390	[2] 2,390		12,667	19,000	21,650	8,960	47,488	71,232	73,882	52,232	.770	28,117	62,883
24 W		2,540	2,540	500	2,040	[2] 2,040		10,812	16,218	18,868	10,380	55,014	82,521	85,171	66,303	.887	21,272	69,728
25 T		1,980	1,980	500	1,480		1,480			2,650				2,650				
26 F	1,480	2,070	3,550	500	3,050	[2] 3,050		16,165	24,247	26,897	9,280	49,184	73,776	76,426	49,529	.796	33,790	57,210
27 S		2,710	2,710	500	2,210	[2] 2,210		11,713	46,852	49,502	2,720	14,416	57,664	60,314	10,812	.628	78,825	12,175
28 S		3,890	3,890	500	3,390		3,390			2,650				2,650				
29 M	3,390	6,530	9,920	500	9,420	8,245	1,175	43,698	65,547	68,197	8,245	43,698	65,547	68,197		.710	96,000	
30 T	1,175	7,550	8,725	500	8,225	[2] 8,225		43,592	65,388	68,038	8,960	47,488	71,232	73,882	5,844	.770	88,361	2,639

[1] Adjusted to 16 hours week days—6 hours Saturdays.

[2] Insufficient water to meet load pattern 74.

*Loss in annual value of capacity—$22.54 x 76,524 kw=$1,724,850.

13 T	3,161	1,370	4,531	500	4,031	2,567	1,464	13,605	20,407	23,057	10,498	55,639	83,458	86,108	63,051	58,051	.897	25,700	65,300
14 F	1,464	900	2,364	500	1,864	[4] 1,864		9,879	14,818	17,468	9,280	49,184	73,776	76,246	58,778	53,778	.796	21,900	69,100
15 S		900	900	500	400	[4] 400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,700	73,300
16 S		900	900	500	400					2,650				2,650					
17 M	400	900	1,300	500	800	[4] 800		4,240	6,370	9,020	8,245	43,698	65,547	68,197	59,177	54,177	.710	12,700	78,300
18 T		900	900	500	400	[4] 400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400
19 W		2,160	2,160	500	1,660	[4] 1,660		8,800	13,200	15,850	10,380	55,014	82,521	85,171	69,321	64,321	.887	17,900	73,100
20 T		3,090	3,090	500	2,590	2,567	23	13,605	20,408	23,058	10,498	55,639	83,458	86,108	63,050	58,050	.897	25,700	65,300
21 F	23	3,090	3,113	509	2,613	2,269	344	12,025	18,038	20,688	9,280	49,184	73,776	76,246	55,558	50,558	.796	26,000	65,000
22 S	344	3,090	3,434	500	2,934	665	2,269	3,524	14,096	16,746	2,720	14,416	57,664	60,314	43,568	38,568	.628	26,700	64,300
23 S	2,269	1,620	3,889	500	3,389		3,389			2,650				2,650					
24 M	3,389	1,370	4,759	500	4,259	2,016	2,243	10,685	16,028	18,678	8,245	43,698	65,547	68,197	49,519	44,519	.710	26,300	64,700
25 T	2,243	1,370	3,613	500	3,113		3,113			2,650				2,650					
26 W	3,113	1,130	4,243	500	3,743	2,538	1,205	13,451	20,176	22,826	10,380	55,014	82,521	85,171	62,345	57,345	.887	25,700	65,300
27 T	1,205	1,130	2,335	500	1,835	[4] 1,835		9,725	14,588	17,238	10,498	55,639	83,458	86,108	68,870	63,870	.897	19,200	71,800
28 F		900	900	500	400	[4] 400		2,120	3,180	5,830	9,280	49,184	73,776	76,246	70,416	65,416	.796	7,300	83,700
29 S		900	900	500	400	[4] 400		2,120	8,480	11,130	2,720	14,416	57,664	60,314	49,184	44,184	.628	17,800	73,200
30 S		900	900	500	400		400			2,650				2,650					
31 M	400	900	1,300	500	800	[4] 800		4,240	6,370	9,020	8,245	43,698	65,547	68,197	59,177	54,177	.710	12,700	78,300
January																			
1 T		900	900	500	400	[4] 400		2,120	3,180	5,830	8,960	47,488	71,232	73,882	68,052	63,052	.770	7,600	83,400

[1] Assuming a pattern of operations parallel to exhibit 74 with a minimum flow of 500 c. f. s.

[2] Flow pattern adjusted where possible to 0.244×flow in exhibit 74. .244=relation of total daily flows for month to totals required by load pattern exhibit 74, both decreased by required minimum flow.

[3] In excess of load pattern because of full storage.

[4] Flow available did not meet load pattern.

[5] Adjusted to: 16 hours—weekdays, 6 hours—Saturdays.

[6] Examiner's decision, p. 81.

[7] U. S. G. S. water supply papers.

Exhibit 81B

Dependable capacity of proposed project at Roanoke Rapids with the natural stream flow of the month of December 1930, and using minimum release of 500 c. f. s. using a load pattern .4033 × the load pattern in exhibit 74, power storage in reservoir 7166 c. f. s.-days

(a) Month and day	(b) Storage beginning day c. f. s.-days (see end of previous day)	(c) Average daily flow c. f. s.	(d) Total available c. f. s. (b)+(c)	(e) Minimum flow required generates 2,650 kw.	(f) Flow available in excess of 2,650 kw.	(g) Flow used for capacity in excess of 2,650 kw.	(h) Storage at end of day c. f. s.-days	(i) Average kw. capacity in excess of 2,650 kw. 24 hr.	(j) Average capacity in excess of 2,650 kw.[1]	(k) Average kw. capacity including 2,650 kw.[1]	(l) Release required for load pattern exhibit 74 in excess of 2,650 kw.	(m) Average kw. capacity required to meet load pattern exhibit 74 in excess of 2,650 kw. 24 hr.	(n) Average kw. capacity required in excess of 2,650 by load pattern exhibit 74[1]	(o) Average capacity required for load pattern 74+2,650 kw.[1]	(p) Average kw. deficiency at Roanoke Rapids[1] (o)−(k)	(q) Load factor load pattern 74	(r) Related peak for Roanoke Rapids-kw. (k)÷(q)	(s) Kw. peaking capacity furnished by Buggs Island after deducting 5,000 kw. for existing plant
Nov.																		
30 S	5,936	1,730	7,666	500	7,166		7,166			2,650				2,650				
Dec.																		
1 M	7,166	1,800	8,966	500	8,466	3,325	5,141	17,623	26,435	29,085	8,245	43,698	65,547	68,197	39,112	0.710	40,965	50,035
2 T	5,141	1,610	6,751	500	6,251	3,614	2,637	19,154	28,731	31,381	8,960	47,488	71,232	73,882	42,501	.770	40,755	50,245
3 W	2,637	1,800	4,437	500	3,937	[2] 3,937		20,866	31,299	33,949	10,380	55,014	82,521	85,171	51,222	.887	38,274	52,726
4 T		1,800	1,800	500	1,300	[2] 1,300		6,890	10,335	12,985	10,498	55,639	83,458	86,108	73,123	.897	14,476	*76,524
5 F		1,930	1,930	500	1,430	[2] 1,430		7,579	11,368	14,018	9,280	49,184	73,776	76,426	62,408	.796	17,611	73,389
6 S		2,000	2,000	500	1,500	1,097	403	5,814	23,256	25,906	2,720	14,416	57,664	60,314	34,408	.628	41,252	49,748
7 S	403	2,220	3,123	500	2,623		2,623			2,650				2,650				
8 M	2,623	2,940	5,563	500	5,063	3,325	1,738	17,623	26,435	29,085	8,245	43,698	65,547	68,197	39,112	.710	40,965	50,035
9 T	1,738	9,370	11,008	500	10,508	3,614	6,894	19,154	28,731	31,381	8,960	47,488	71,232	73,882	42,501	.770	40,755	50,245
10 W	6,894	8,220	15,114	500	14,614	[3] 7,448	7,166	39,474	59,211	88,817	10,380	55,014	82,521	85,171		.887	96,000	
11 T	7,166	5,430	12,596	500	12,096	[2] 4,930	7,166	26,129	39,194	41,844	10,498	55,639	83,458	86,108	44,264	.897	46,649	44,351
12 F	7,166	3,950	11,116	500	10,616	3,743	6,873	19,838	29,757	32,407	9,280	49,184	73,776	76,426	44,019	.796	40,712	50,288
13 S	6,873	3,260	10,133	500	9,633	[2] 2,467	7,166	13,075	52,300	54,950	2,720	14,416	57,664	60,314	5,364	.628	87,500	3,500
14 S	7,166	2,980	10,146	500	9,646	[3] 2,480	7,166	13,144						2,650				
15 M	7,166	2,540	9,706	500	9,206	3,325	5,881	17,623	26,435	29,085	8,245	43,698	65,547	68,197	39,112	.710	40,965	50,035
16 T	5,881	2,370	8,251	500	7,751	3,614	4,137	19,154	28,731	31,381	8,960	47,488	71,232	73,882	42,501	.770	40,755	50,245
17 W	4,137	2,290	6,427	500	5,927	4,186	1,741	22,186	33,279	35,929	10,380	55,014	82,521	85,171	49,242	.887	40,506	50,494
18 T	1,741	2,220	3,961	500	3,461	[2] 3,461		18,343	27,515	30,165	10,498	55,639	83,458	86,108	55,943	.897	33,629	57,371
19 F		2,220	2,220	500	1,720	[2] 1,720		9,116	13,674	16,324	9,280	49,184	73,776	76,426	60,102	.796	20,507	70,493
20 S		2,370	2,370	500	1,870	1,097	773	5,814	23,256	25,906	2,720	14,416	57,664	60,314	34,408	.628	41,252	49,748
21 S	773	2,140	2,913	500	2,413		2,413			2,650				2,650				
22 M	2,413	2,370	4,783	500	4,283	3,325	958	17,623	26,435	29,085	8,245	43,698	65,547	68,197	39,112	.710	40,965	50,035
23 T	958	2,890	3,848	500	3,348	[3] 3,348		17,744	26,616	29,266	8,960	47,488	71,232	73,882	44,616	.770	38,008	52,992
24 W		2,540	2,540	500	2,040	[2] 2,040		10,812	16,218	18,868	10,380	55,014	82,521	85,171	66,308	.887	21,272	23,922
25 T		1,980	1,980	500	1,480		1,480			2,650				2,650				
26 F	1,480	2,070	3,550	500	3,050	[3] 3,050		16,165	24,248	26,898	9,280	49,184	73,776	76,426	49,528	.796	33,791	57,209
27 S		2,710	2,710	500	2,210	1,097	1,113	5,814	23,256	25,906	2,720	14,416	57,664	60,314	34,408	.628	41,252	49,748
28 S	1,113	3,890	5,003	500	4,503		4,503			2,650				2,650				
29 M	4,503	6,530	11,033	500	10,533	[3] 3,367	7,166	17,845	26,768	29,418	8,245	43,698	65,547	68,197	38,779	.710	41,053	49,947
30 T	7,166	7,550	14,716	500	14,216	[3] 7,050	7,166	37,365	56,048	58,698	8,960	47,488	71,232	73,882	15,184	.770	76,221	14,769

[1] Adjusted to: 16 hr.-weekdays, 6 hr.-Saturdays.

[2] Insufficient water on this day to meet pattern (.4033 × LP 74) requirements.

[3] Excess power over pattern because of limited storage.

*Loss in annual value of capacity = $22.54 × 76,524 kw = $1,724,850.

TESTIMONY OF MR. CARY

[2960] Direct examination by Mr. GIBSON:

[2961] Q. Mr. Cary, much has been said in the evidence in this case presented through Mr. Hamilton and Mr. Creim in regard to your Exhibit 74, based on which those witnesses have prepared Exhibits 79, 80, 81, and 87. Will you kindly explain just why Exhibit 74 was prepared in the way in which it was prepared, and what it was intended to show?

A. Exhibit 74 was prepared at the request of counsel for the Secretary of the Interior to illustrate, based on certain assumptions, how we expected to operate the Roanoke Rapids project during the week of peak load in December 1953.

I had previously introduced Exhibit 61 particularly to show the effect on the expected operations which would result from the restrictions on rate of increase in discharge, assuming most extreme conditions of operation on the very top of the peak, which required the most extreme increase in generation.

In cross-examination on this, Mr. Hankin was especially interested in having a chart of actually expected, rather than extreme and hypothetical, operation. Therefore, I prepared the series of Exhibits, 72 through 76, to illustrate actually expected methods of operation.

Q. In your Exhibit 74, what were your basic assumptions as to water available, and why were they made?

A. Since the Roanoke Rapids plant will be downstream from Buggs Island, it naturally follows that

the Roanoke Rapids [2962] plant must use the releases from Buggs Island together with the inflow to the river below Buggs Island. To make any estimate of operation of Roanoke Rapids, it was necessary to make some assumption as to the operation of Buggs Island and the corresponding release of water.

The only estimate then, and the only estimate now, of the operation of Buggs Island and its seasonal variation in releases is contained in the Definite Project Report on Buggs Island, Exhibit 10. These estimates of operation were used in preparing all Exhibits 72 to 76, inclusive.

Q. What average flow from Buggs Island in c. f. s. did your Exhibit 74 assume?

A. Approximately 7,000 c. f. s.

Q. Why did you use that figure?

A. That is the release necessary to give the Army Engineers' figure for December power output in a year of critically low flow, as given in the Definite Project Report, in Exhibit 10. I assumed the same flow throughout the month, without any increase in the week of peak load.

* * * * *

[2967] By Mr. GIBSON:

Q. Are we to assume that you would operate Project 2009 in the manner assumed by Exhibit 74 for all variations in flow that you might encounter, that you may have during the month of December?

A. No. The operation shown on Exhibit 74 is only for the conditions assumed and the flow corresponding to those conditions. If the flow should be

greater than assumed, the operation would be lower down on the system-load curve, and [2968] if the flow should be less than assumed, the operation would be higher up on the load curve.

Q. On page 2861 of the transcript, Mr. Hamilton yesterday, in stating the reasons why, in preparation of his exhibits, particularly Exhibit 79, testified as to his reasons why he did not increase the 4,310 c. f. s. flow by 50 per cent. One of his reasons was, and I quote: "Table VI–3 is predicated on the assumption that such holding back of water would be necessary to meet the load requirements of existing public utilities." He then added the following statement regarding certain of your former testimony, and I quote: "This is the assumption that was made by Mr. Cary when he testified on page 456 of the transcript," and he there quoted you as follows: "We have assumed all through our studies that the power output from Buggs Island would be used to supply utility systems of some sort, and that on that assumption we are not worried at all about the releases of water from Buggs Island."

It now appears from Mr. Creim's evidence that he contemplates that certain sales of power from Buggs Island may be made to purchasers other than utility systems, such as Federal agencies, illustrated by Mr. Creim in the case of NACA, and to other Governmental activities in the Norfolk area, such as shipyards and military camps.

Mr. Cary, would such sales to such Federal agencies, or to other than utility systems, affect your plan regard-

ing the [2969] proposed operation of Roanoke Rapids project, or its feasibility? If so, will you explain to what extent?

A. Such sales to Federal agencies or others than utility systems would not change the plan of operation. Such sales may result in somewhat different regulation of the Roanoke Rapids pond so as to re-regulate the flow released from Buggs Island for most efficient use on applicant's system load.

Most of the Federal agencies mentioned by Mr. Creim, were of the industrial type or of the military or naval base or camp type. Such loads are reasonably regular in their power requirements and would not be substantially different from utility system loads, as utility system loads are made up partly of such loads.

The hour to hour operation of Buggs Island is of no significance in the operation of Roanoke Rapids. The Roanoke Rapids pond has ample storage capacity to regulate the flows which such sales would create.

Q. If you were asked to state how you would operate Roanoke Rapids plant, if there were a continuous flow of 18,500 c. f. s. for a long period, would you place the output of the Roanoke Rapids unit at the same place on your load curve as shown in your Exhibit 74?

A. No. Operation of Roanoke Rapids to use a continuous flow of 18,500 c. f. s. for a long period would require full output [2970] of 96,000 kilowatts, including the existing plant, continuously. Such operation would be at the base of the system load curve.

Q. If that is so, would you put it down on the load curve lower than the operation with the Buggs Island release of 7,030 c. f. s., which you assumed, as you say, when you developed Exhibit 74?

A. That is correct.

Q. Mr. Creim testified that his operation of Buggs Island would not decrease the flow available at Roanoke Rapids below the natural flow. You have testified in this case that the operation described in Exhibit 61 would make the full 91,000 kilowatts capacity of the project dependable on the applicant's system load for the week of annual peak load in December 1953. Would the natural flow in the critical month permit you to operate as described in Exhibit 61?

A. Yes, it would. The type of operation shown on Exhibit 61 would require an average flow of 1,825 c. f. s. The operation in other weeks of December would require less average flow because the week shown in Exhibit 61 is the week of peak load and such weeks rarely repeat.

The average required flow for the entire month, therefore, would be less than 1,825 c. f. s. Exhibit 51, sheet 2, shows that the natural average flow in the critical December month was 2,190 c. f. s. in 1917. The required flow is less than [2971] the natural flow available.

Therefore, the natural flow in the critical month will permit operation as described in Exhibit 61.

Q. You will recall that in your series of exhibits, 72 through 76, for all but Exhibit 74 you showed two load patterns, two for April and two for August, but

in the case of Exhibit 74 for December, there was only one pattern. Why is it that Exhibit 74 shows the same operations for both the average year and the critical year? I mean average water year and critical water year.

A. Exhibit 74 was based on average generation at Buggs Island of 34,500 kilowatts in December of the 332-day critical dry period. That figure was obtained from Table VI–3 on page VI–10 of Exhibit 10, the Army's Definite Project Report. That output represents a release of about 7,000 c. f. s. at the draw-down at Buggs Island, which that report showed would occur in December.

For average water conditions, the flow and power regulation assumed in the Definite Project Report works out to a release at Buggs Island of 7,030 c. f. s. in December, or approximately the same as in the critical flow year. This figure comes from Exhibit 29, Table 4.

We, therefore, showed in Exhibit 74 the operation in the critical year to be the same as in the average year.

Q. Scaling the values shown on Exhibit 74, what is the [2972] average flow of the project for that week shown?

A. My figures work out to about 7,680 c. f. s.

Q. Is there any reason for this difference between 7,000 c. f. s. and 7,680 c. f. s?

A. Yes. There is reason for that in the inflow to the river below Buggs Island. There is also some difference brought about in detailed computations and in scaling to and from the charts.

Q. What energy was estimated to be available at the Roanoke Rapids project and the existing plant in Exhibit 74?

A. 7,050,000 kilowatt-hours for the entire week.

Q. How did you determine what position the plant, with that amount of output, would occupy on the load curve?

[2973] A. The assumed minimum release of 1,000 c. f. s. would produce 890,000 kilowatt-hours, and since it was a minimum release that energy was placed at the bottom of the load curve continuously for the entire week. A cut and try procedure showed that 337,000 kilowatt-hours would be produced from the water utilized in complying with the recommended maximum rate of increase in discharge.

The remainder of the energy was put into a horizontal band on the load curve where the energy required for load was equal to the energy available, and where the capacity enclosed by the upper and lower boundaries of the band was equal to 96,000 kilowatts, less than 5,300 kilowatts of base load power represented by the minimum release of 1,000 c. f. s.

Q. If the release from Buggs Island were less than assumed in Exhibit 74, would the applicant operate the plant at the same position on the system load curve as in Exhibit 74, and with the pattern of load as shown on Exhibit 74?

A. No.

Q. Why not?

A. The estimated energy available would be less if the flow were less, and the energy would be placed

higher on the load curve where the horizontal band requires less energy. The upper and lower boundaries of the band and the 5,000 kilowatts of base load would still be equal to 96,000 kilowatts.

Q. Is the 5,000 kilowatts the base load?

[2974] A. 5,300 kilowatts, I should have said.

Q. Has there been shown in the record the uppermost position on the load curve at which the project and the existing plant could provide 96,000 kilowatts of dependable capacity on the applicant's system load?

A. Yes. That is shown in Exhibit 61.

Q. Does that operation require as much energy as that assumed by Exhibit 87?

A. No; only a fraction of that amount.

Q. What would your answer be as to Exhibits 74, 79, 80, and 81?

A. Exhibit 61 only requires a fraction of the energy required by any of those other exhibits.

Q. In describing these operations for locating the operation of the plant on the system load curve, I ask if you have prepared a chart which shows the relative locations on the estimated December 1953, load curve at which you would operate the plant with the generation indicated on Exhibit 74 in the one case, and with the generation indicated on Exhibit 61 in the other case?

A. Yes; I have.

Q. Was this chart prepared from any new data, or only from data of record in this case?

A. Only from data in the record. The chart places on one sheet the loads and generation described by three exhibits, [2975] Exhibits 29, 74, and 61.

Q. Is this the chart you have described?

A. Yes, sir.

Mr. GIBSON. I ask that this chart, described by Mr. Cary, be introduced in evidence and marked as "Exhibit 92."

CHIEF PRESIDING EXAMINER. It will be marked for identification "Exhibit No. 92."

(The document above referred to was marked Exhibit No. 92, for identification.).

By Mr. GIBSON:

Q. Mr. Cary, you mentioned that the exhibit places on one sheet of paper three previous exhibits in the case, and including a part of Exhibit 29, and the values shown on Exhibits 74 and 61. What part of Exhibit 29 is placed on this exhibit?

A. The load curve on this exhibit is the same estimated weekly load curve for December 1953, as contained in Exhibit 29.

Q. I believe that in the reproduction there were some imperfections came through in the process. Can you describe which of the lines are not part of the graph to be read?

A. Yes. In the printing of these reproductions, it is evident that there are a few faint lines, most of them extending out into the margin, that should not be used in reading figures from the chart. I think it is fairly evident to anybody that is familiar with graph paper.

[2976] Q. Are the lines representing each 100 megawatts on the company's system load curve, those that

appear opposite the numerals given in the megawatts column?

A. They are the correct lines to use.

Q. Where is Exhibit 61 shown on this exhibit, and how do you read it?

A. The solid black shading at the top of the load curve shows the same operation as contained on Exhibit 61, above the generation of 5,309 kilowatts, which is obtained from the assumed minimum flow of 1,000 c. f. s., and excluding the generation represented by the cross-hatched area shown on Exhibit 61.

The 5,300 kilowatts generation from the minimum flow assumed on Exhibit 61 is shown at the bottom of this exhibit, by the horizontal line.

The equivalent of the cross-hatched area on Exhibit 61 representing the generation resulting from limitation of rate of increase or discharge, is shown by the solid black areas in the lower part of this exhibit, as noted on the exhibit.

Q. What about Exhibit 74?

A. The cross-hatched area in the upper part of the load curve on this exhibit shows the same generation as that on Exhibit 74, above the generation of 5,300 kilowatts, which is from the assumed minimum flow of 1,000 c. f. s., and excluding the cross-hatched areas on Exhibit 74.

The 5,300 kilowatts of generation from the assumed minimum [2977] flow of 1,000 c. f. s. shown on Exhibit 74 is shown on this exhibit by the same horizontal line at the bottom of the exhibit previously mentioned.

The generation resulting from the limitation of rate of increase of discharge shown in the cross-

hatched areas of Exhibit 74 is shown by the cross-hatched areas at the bottom of this exhibit.

Q. Give us further a more informal explanation of that exhibit. Could you point out to the Examiner what the subject of your testimony has been?

A. I will be glad to do that. I think everything on the exhibit is quite clear to anybody who will look at it, except possibly those indications near the bottom of the chart showing the "generation resulting from limitation of rate of increase of discharge."

If you will recall, Exhibit 61, for instance, showed the cross-hatched areas right ahead of the requirements for load. They were necessary to meet the rate of increase, but naturally generated power.

In this exhibit, in order to show the comparison between the two it was necessary to show that portion of the generation in another place in order not to confuse the upper part of the curve.

It will be noted, for instance there on Monday, that first solid black line down near the bottom is one hour, or, rather, [2978] is in the hour ahead of the generation indicated up at the peak of the curve, and that same thing is true on each of the days there, except on Wednesday and Thursday it shows some generation for that purpose in the two hours immediately ahead of the sharp evening peak.

Now, in regard to the cross-hatched areas near the bottom that shows the same data in regard to Exhibit 74 and indicates the generation obtained from the releases of water required on account of that rate of increase limitation. It will be noted that in each case the generation is in the one or two hours im-

mediately ahead of the rapid rise in generation shown up in the larger cross-hatched area near the top.

Q. Adding in the 5,300 kilowatts at the base, how much capacity is included in the cross-hatched area in the middle of this load curve?

A. The total capacity from the project, between the horizontal lines of the cross-hatched area in the upper part, is 90,700 kilowatts, which, together with the 5,300 kilowatts which is indicated by that small narrow area under the solid line at the bottom, between the zero line and the solid heavy line, the two together make the 96,000 kilowatts capacity that is obtained from the Roanoke Rapids project, together with the existing plant of Roanoke Rapids.

Q. Then adding in that 5,300 kilowatts at the base of the load to what is shown in solid black at the top, how much [2979] capacity is there?

A. In the solid black area there, which represents the same as Exhibit 61, at the time of peak which occurs during only one hour, which is between five and six p. m. on Thursday, in the upper part at the top of the load curve there again the capacity is that 90,700 kilowatts, which, together with the same 5,300 down at the base, gives the total capacity of 96,000 kilowatts from the two plants.

Q. Is the 96,000 kilowatts of capacity in either of those two cases carried on the company's system load for the week of December 1953?

A. Yes. In either case, the areas represented by 61, or, rather, the operation represented by 61 or the operation represented by 74, both carry the full 96,000

kilowatts on the company's system load for the time it is required.

As a matter of fact, the operation there for Exhibit 74 carries it for more time than is actually required.

Q. You have testified as to variation of the position of the plant operation on the load curve in case of a varying amount of water available, or varying conditions. Will you please explain how you would vary the plant operation to derive full capacity and utilize all the energy from the water available under varying conditions?

[2980] A. The solid black area, together with the unshaded area below the horizontal line at the bottom of the chart, show how the applicant would operate the Roanoke Rapids Project and the existing plant on the load curve if operated only as required to be dependable on the load for 96,000 kilowatts with minimum generation. This operation has nothing to do with the existence or operation of Buggs Island. With or without Buggs Island this is the minimum required operation necessary to utilize the full capacity dependable on the system load.

It can be seen that the 5,300 kilowatts resulting from the assumed minimum flow requirement of 1,000 c. f. s. would operate continuously as a base load shown at the bottom of the chart. The remaining 90,700 kilowatts of capacity would carry those loads above 629,300 kilowatts, up to the peak of 7,200 kilowatts, and the plant would operate——

Q. What was the top peak? I didn't catch the figure.

A. 720,000 kilowatts, and the plant would operate during periods of rapid increase in generation in advance of the sharp peaks as indicated near the bottom of the chart, which generation would be used to displace generation on the steam stations.

To carry out such operation during this week of annual peak load in December 1953, an average river flow of only 1,825 c. f. s. is required.

[2981] The cross-hatched areas, together with the unshaded area below the solid line at the bottom of the chart, show how the project, together with the company's existing plant at Roanoke Rapids, would be operated on the load curve under the conditions assumed in Exhibit 74. That is assuming Buggs Island to be operating with the seasonal regulation of flow described by the Army Engineers for the month of December, as shown in Exhibit 10.

Under these conditions, substantially more water would be released from Buggs Island than would be required by the Roanoke Rapids Project to make its full capacity dependable upon the system load, but the Roanoke Rapids Project, together with the company's existing plant, would simply, using the universal language of operating engineers, move down on the load curve to a point where it would efficiently use all of the water released from Buggs Island, converting that into energy and carrying the load for longer periods.

The positions at which to operate on the load curve were easily determined by the use of the curve contained in Exhibit 29 entitled, "Integrated Kilowatt-

Hours versus Kilowatts, December 1953." In this case, that is, under the assumptions of Exhibit 74, in addition to carrying the 5,300 kilowatts of base load, shown at the bottom of the load curve, resulting from the assumed minimum flow of 1,000 c. f. s., the plants could carry that 90,700 kilowatts block of load between system loads [2982] of 484,300 kilowatts, and 575,000 kilowatts.

The additional generation shown by the cross-hatched areas at the bottom of the load curve resulting from a limitation of rate of increase of discharge would simply displace steam generation with a corresponding saving in fuel. Such operation would efficiently use the assumed average discharge from the Buggs Island project of about 7,000 c. f. s. and the additional in-flow to the Roanoke Rapids project from the drainage area below Buggs Island.

If the average in-flow to the project were any amount other than that assumed in Exhibit 74, the operation would be represented by a similar cross-hatched band of the same magnitude vertically of 90,700 kilowatts, but located lower down on the load curve in case the flow were greater, and higher on the load curve in case the flow were less.

The total generation represented by the total area of the cross-hatched band and the cross-hatched sections, plus the unshaded area at the bottom of the load curve representing the generation from the assumed minimum flow, has a direct relation to the average in-flow to the project and it can be readily seen that by moving the cross-hatched band up on the

load curve, the total area will be decreased, and by moving the cross-hatched band down on the load curve, the total area can be increased.

The actual control of such operations is a simple matter [2983] of load-dispatching which is common practice on utility systems.

Q. Moving of the generation represented by the cross-hatched band, moving that up or down on the load curve would have what effect on the load factor of generation from the project, together with the existing plant?

A. Moving the generation down on the load curve to use greater flow would result in increasing the load factor of the generation. Moving the generation up on the load curve to use lesser flow would result in decreasing the load factor of generation.

The load factor used in Exhibits 79, 80, 81, and 87 is not fixed, but is determined by the position on the load curve at which the plant is operated.

Q. Would the operation of Buggs Island Reservoir, in such a manner as to generate power for sales requiring energy to be supplied during irregular hours and in the off-peak hours, in any way affect the dependable capacity of the Roanoke Rapids project?

A. Not at all. The pondage at Roanoke Rapids would be more than adequate to receive such irregular flows and permit use at Roanoke Rapids to serve the requirements of the applicant's system load. In fact, sales by the Administrator from Buggs Island during off-peak hours, such as on NACA loads,

would require less use of pondage at Roanoke Rapids than on peak [2984] sales, due to the time lag in the flow of water from Buggs Island to Roanoke Rapids. This factor was carefully studied by our engineers, Charles T. Main, Incorporated, and the results incorporated in Exhibit 29 on page 4.

Q. On Exhibits 79, 80, 81, and 87, there is a figure for storage given. It is given in the maximum amount of 5,000 c. f. s. days. Is that the correct figure for the total amount of storage at the Roanoke Rapids project?

A. No, it is not. 5,000 c. f. s. days is only storage in the top 2 feet of the pond; approximately.

Q. What is the total amount of usable storage?

A. It would be entirely practicable to draw the pond down as much as 5 feet and still maintain a capacity of 91,000 kilowatts. The top 5 feet of the pond contains a storage of approximately 10,600 c. f. s. days.

* * * * * *

[2986] By Mr. GIBSON:

Q. Will you turn to Exhibit 82, introduced through Mr. Hamilton, Mr. Cary?

A. I have it.

Q. On that exhibit, does vertical distance represent capacity?

A. It does.

Q. Does total area included within the blocks superimposed upon the exhibit represent energy?

[2987] A. It does.

Q. Whatever Mr. Hamilton's and Mr. Creim's views of dependability, and whatever Mr. Hamilton's

views of the $27,000,000 investment, does the energy enclosed in the cross-hatched area represent the 96,000 kilowatts of capacity?

A. It does.

Q. Is that 96,000 kilowatts of capacity, 91,000 of it from Project 2009, dependable capacity on the applicant's system load?

A. It is.

Q. Is there any fact in Mr. Hamilton's exhibits introduced in this reopening, or in Mr. Creim's Exhibit 87, which indicates to the contrary?

A. None whatever.

Q. In the final analysis, what is the crux of your reason for that statement?

A. My reason for that opinion is that all of those exhibits, 79, 80, 81, and 87, are based on the assumption that the operation indicated on Exhibit 74 is required or necessary for the project to be dependable on the system load, and there is absolutely no basis for that assumption.

* * * * * *

[2988] Cross-examination by Mr. GATCHELL:

Q. Mr. Cary, suppose that only flows equivalent to the natural flow were available during December at the Roanoke Rapids project; where, on your system load, would you operate the Roanoke Rapids project?

A. Did you state with the critical low flow or any flow?

Q. I said the natural flows, flows equivalent to the natural flow were available during December.

A. That would depend upon what the natural flow was in that December. If the natural flow were—

let me make sure that I understand that question.

Q. The flows equivalent to the natural critical flow; take it that way, first.

A. Are you assuming the Buggs Island project in operation or not in existence?

Q. Assume it both ways for the purpose of your answer. You know the Buggs Island project is under construction; I don't see how you could eliminate that from the picture.

A. Assuming the Buggs Island project in operation at the [2989] time, the natural flow of the river would not affect the operation at Roanoke Rapids, because Roanoke Rapids under those conditions would operate with the least flow from Buggs Island.

Q. If those flows coming down were equivalent to the natural flows, would that make any difference?

A. Yes. In that event, the Roanoke Rapids project would operate at that point, at that band, on the system-load curve so as to efficiently use up all of the water that was flowing. If there was a small amount of water flowing, that band would be up nearer the top of the load curve. If the flows were greater, it would be lower down on the load curve.

Q. Is it your testimony that you would place the Roanoke Rapids plant on the load of Virginia Electric and Power Company's system according to the amount of water available?

A. At the Roanoke Rapids project; yes.

* * * * *

[3026] Cross-examination by Mr. HANKIN:

Q. Mr. Cary, on page 2961 of the transcript you testified that you had prepared Exhibit 74 at the request of counsel for the Secretary of the Interior. You mean, of course, that the exhibit was prepared in order to facilitate your cross-examination. Is that the import of your statement?

A. Well, I imagine that was the reason it was requested.

Q. And is that the reason why you furnished it?

A. I furnished it because I was required to furnish it, I thought.

Q. I mean there is no implication that because it was requested by the Secretary of the Interior therefore it had [3027] less weight in your mind.

A. No; I don't think so.

Q. You had testified previously that you had introduced Exhibit 61 particularly to show the effect on the expected operations which would result from the restrictions included in Exhibit 80 on the rate of increase in the discharge of water from the Roanoke Rapids project assuming the most extreme conditions of operation, is that correct?

A. That is correct.

Q. I take it that you had reference to your testimony on page 1697 and following of the transcript in which you stated that you disagreed with Mr. Hamilton's statement that the Roanoke Rapids project could not be operated as a peak load plant. You there testified that Exhibit 61 represented a hypothetical case of extreme limitation in which the

project would still have its full capacity during the peak load in the month of December; is that correct?

A. I think that is correct.

Q. And later I cross-examined you on Exhibit 61 and asked you whether this exhibit represented the operation of the proposed Project Number 2009 and the existing plant in December 1953, and you answered that Exhibit 61 represented a hypothetical condition which you have described in your testimony and showed what the operation would be if you operated the project to carry the top 96,000 kilowatts of [3028] all the load above 624,000 kw.; is that correct?

A. That is correct.

Q. I asked you further whether by hypothetical representation you meant that it was an estimated representation of how you would operate in December 1953 and you answered, no, it is not that at all.

A. That is correct.

Q. Beginning with page 1958 of the transcript, I began a series of questions asking you how you intended to operate during a week of December 1953 and asked you to show for each hour and each day the amount of your releases of water and the amount of the capacity you would obtain, both under the hypothetical Exhibit 61 and under normal conditions; is that correct?

A. I think that is correct.

Q. If you will recall, this continued throughout the entire morning, almost, on June 10, 1949, and then it was agreed that you would submit in exhibit form

your pattern of operations in the months of December 1953, April and August 1954; is that correct?

A. That is correct.

Q. And then on June 16, 1949, Mr. Gibson offered Exhibits 72 through 76 and he asked you, on page 2287 of the transcript, to state the difference between Exhibit 74 and Exhibit 61 as follows. The question was: "Why is not [3029] the December chart, Exhibit 74, identical in appearance with Exhibit 61?" to which you answered, "Exhibit 61 shows a hypothetical condition to illustrate the extreme effect of a sharp variation in load and to show the effect of that sharp variation on the requirement for a gradual change in the rate of flow from the limitations recommended in Exhibit 8, the letter from the Army Engineers. The hypothetical condition there was not intended to represent the actual condition but simply to show that the project could operate with a very rapid change in output with that limitation applied to it." Quoting further, "Exhibit 74, for the month of December, is intended not to show the hypothetical condition, but our best estimate of conditions that are expected to actually take place in December 1953." Is that correct?

A. That is correct.

Q. Do I understand that now, after Exhibits 79, 80, 81, and 87 have been introduced, you have changed your mind about the character of Exhibits 61 and 74?

A. Not a bit.

Q. Does Exhibit 61 still represent a hypothetical extreme condition?

A. Exhibit 61 represents exactly what I said it would represent when I put it in. I said it represented a hypothetical condition and I also stated at the same time that it [3030] represented the operation required of the project to carry that top 96,000 kilowatts of load.

Q. Will you please answer my question. Does Exhibit 61 still represent a hypothetical extreme condition?

* * * * *

The WITNESS. It does represent a hypothetical condition and it also represents exactly what I said it would operate in that it represents what was required to carry the top 96,000 kw.'s of load on this system.

By Mr. HANKIN:

Q. All I am interested in at the present time is in knowing whether it represents a hypothetical extreme condition. I take it your answer is yes.

A. Well, you are not quoting me. The record will show what I said.

* * * * *

Q. Yes; the record will show what you said. Now, if that does represent a hypothetical extreme condition, how do you reconcile your statement on page 2287 of the transcript with the statement on page 2974 where you treat Exhibit 61 as being equally normal with Exhibit 74?

* * * * *

[3031] The WITNESS. I am not familiar with those pages in the transcript.

Mr. HANKIN. I would be very glad to refer you to the two pages. I shall ask you to reconcile your two statements.

Mr. GATCHELL. What are the page references?

Mr. HANKIN. 2287 and 2974.

* * * * *

The WITNESS. On page 2287 my statement there is correct but it is only part of the statement that I made when I [3032] put Exhibit 61 in. When I introduced Exhibit 61 I made a more complete statement and that is only part of it. If anybody can give me the page where 61 was introduced into the record, I would like to read that second part. Can somebody give me the page reference as to where Exhibit 61 was introduced?

* * * * *

The WITNESS. I would be glad to explain it, but I would like to find the reference.

Mr. HANKIN. Here it is:

The WITNESS. On page 1697 of the transcript, in response to a question by Mr. Gibson asking me to explain what is represented by the exhibit, I made the following statement. I quote from the transcript, line 16 on that page. "This exhibit contains a curve for each of the five heavy load days during that week. Each of these curves shows the amount of load required to be carried by the project together with existing hydro plant at Roanoke Rapids on the assumption that all except the top 96,000 kw.'s of load is carried by [3033] other sources of power." Now, that was where I was making it clear, I thought, that

Exhibit 61 showed what was required to be generated on the project to make it dependable on the system load. I also made the statement that it represented a hypothetical condition because we did not expect the actual river flow conditions at the project to be such as to require that type of operation, and therefore it did not actually represent our estimate of the expected operations but rather what would be required to make it dependable on the system load.

By Mr. HANKIN:

Q. Therefore, when I asked you if it represented your expected operations, you said no, not at all. When you were asked by Mr. Gibson to differentiate between the two, you called one a hypothetical condition of extreme limitations and the other one was your actual expected operation. Now, let me ask you this question. Does Exhibit 74 still represent your best estimate of the actual pattern of operations in the month of December during both a critical and average flow period?

A. It represents the estimate of operations on the assumption that Buggs Island would be operated as contemplated by the Army Engineers as recorded in the Definite Project Report, which is Exhibit 10.

Q. That is what you expect to be the actual operations.

[3034] A. Under those conditions.

Q. Now, if that is the case, how do you reconcile this description of Exhibit 74 with your statement on pages 2967 and 2968? I believe you have a copy there. In answer to a question by Mr. Gibson, as fol-

lows: "Are we to assume that you would operate Project 2009 in the manner assumed by Exhibit 74 for all variations in flow that you might encounter, that you may have during the month of December?" you answered: "No, the operation shown on Exhibit 74 is only for the conditions assumed and the flow corresponding to those conditions. If the flow should be greater than assumed, the operation would be lower down on the system load curve, and if the flow should be less than assumed, the operation would be higher up on the load curve." Can you reconcile your statement that Exhibit 74 represents your expected actual operations both during the critical and average flow period with this statement that you made in answer to Mr. Gibson?

A. Yes; I think I can reconcile that.

Q. Please do it.

A. Exhibit 74 was drawn to show the estimated operations under a stated set of conditions. Now, that did not necessarily mean that those conditions would always exist. But they were the best estimate I had on the operation of Buggs Island. And if Buggs Island released water as contemplated [3035] in the Definite Project Report, Exhibit 74 represented the operation that would be expected at Roanoke Rapids under those same conditions. Now, if the Buggs Island project is operated differently from that, this statement that you have just read shows—it is a general statement as to how the operation at Roanoke Rapids would be varied to use whatever flow does come down the river.

Q. I want to call your attention, Mr. Cary, that Exhibit 74 is the pattern of operations for both the average and the critical flow period. Therefore, when you state that Exhibit 74 applies to stated conditions, those conditions have a variation anywhere from critical flow to average flow; isn't that so?

A. Not necessarily. No; I don't think that follows at all.

Q. Then would we say that Exhibit 74 has a wrong designation on it?

A. No; I think it is very carefully stated.

Q. Do you happen to have Exhibit 74 before you?

A. I think Exhibit 74 has a very accurate statement at the top of it as to exactly what the assumed conditions are.

Q. If you will look at the top of Exhibit 74, it says that it is the estimated variation, etc., and then right below, in caps, "Week of peak load, December 1953, [3036] Average and Critical River Flow Year."

A. I think I explained that the last time I was on the stand. The Definite Project Report shows that the estimated release of water from Buggs Island in the month of December is the same in the average year, or approximately the same in the average year, as it is in the year of critical river flow.

Q. Will you remember that when you come to that point, Mr. Cary? Thank you. How do you reconcile your previous statement that Exhibit 74 represents your actual operation with your statement on page 2987 of the transcript that there is absolutely no basis for the assumption that the operation indicated

on Exhibit 74 is required or necessary for the project to be dependable on the system load?

A. I didn't quite follow your question. What are the two statements?

Q. Reconcile that Exhibit 74—I am still going back to your testimony on page 2287 of the transcript—represents not the hypothetical condition, but your best estimate of the actual operations of the project during both an average and critical flow year. How do you reconcile that with the statement that there is absolutely no basis for the assumption that the operation indicated on Exhibit 74 is required or necessary for the project to be dependable on the system load?

[3037] Mr. GIBSON. I think you gave the wrong page reference, Mr. Hankin, but that is all right.

Mr. HANKIN. What is the correct one? I have 2968.

Mr. GIBSON. I thought you said 2987.

Mr. HANKIN. No, 68. The last thing I quoted was from page 2987.

* * * * * *

The WITNESS. I don't recall and I don't believe it is in the record anywhere that I made any statement that indicated that operation in accordance with the pattern shown on Exhibit 74 was required operation. It was an estimated operation to efficiently use a certain release of water.

By Mr. HANKIN:

Q. Well, Mr. Cary, in the cross-examination which took place in June of 1949 it was evident that the

entire object was to determine whether you actually had a dependable capacity of 91,000 kilowatts, and for this reason I went into numerous questions in order to see how much water would be available in the critical and the average month, how much water would be released, at what times, and how you would obtain 91,000 kilowatts. Then came the matter of distinguishing **[3038]** between Exhibit 61 and Exhibit 74.

A. I think you are a little in error there. All of the questions that led up to the presentation of Exhibit 74 had to do with expected actual operation and not with what was required. I don't recall that you mentioned anything about what was required when you were asking your questions that led up to the introduction of Exhibit 74.

Q. Do I understand that if my purpose behind those questions was different you would have given a different answer to the questions actually asked?

A. If you had asked me to put in an exhibit to show what was the required operation, I would have told you it was in in the form of Exhibit 61.

Q. What do you mean by the required operation?

A. The operation of the project that is required to make its capacity dependable on the system load.

Q. Isn't that the same thing as to say what would be your operations in view of your system load curve, and therefore we shall see whether it actually has a dependable capacity of 91,000?

A. No; they are two entirely different subjects. They have no relation to each other.

* * * * *

[3039] By Mr. HANKIN:

Q. Mr. Cary, since you stated that Exhibit 74 is what you actually expected the operations to be, both during the critical flow period and the period of average flow, would you say that the feasibility of the proposed project is to be tested by the pattern of operations of Exhibit 74, which is your estimate of actual operations, or by Exhibit 61, which represents an extreme hypothetical condition?

* * * * *

The WITNESS. I understood the wording but not what is intended. If you make it a little clearer——

By Mr. HANKIN:

Q. Here you have two exhibits. One you have described as the actual expected operations during the proposed average and critical flow period. That is Exhibit 74. The other one is Exhibit 61, which you described as a hypothetical representation—a condition of extreme limitations. Which of these two should constitute a basis for testing the feasibility [3040] of the project? Is it what you would be able to do in the extreme hypothetical condition or what you would be able to do in an actual condition?

A. In my opinion, neither one of those exhibits comes into the testing of the project, the feasibility. As a matter of fact, at the time we made our statement of feasibility, neither one of those exhibits existed.

Q. You mean neither of those exhibits nor the equivalent information existed when you made your test?

A. I wouldn't say the equivalent information didn't exist. Certainly it should not be used in determining feasibility.

Q. You would use only the pattern that you would operate the project on in extreme hypothetical cases. That is the test that you would use to determine the feasibility of the project, not the actual operations?

A. I would like to remind you again that Exhibit 61 shows two things. It showed that extreme operation that you keep referring to. As I just read a minute ago, it also shows the required operation for the project to be dependable on the system load. There is another thing. Exhibit 61 does not show the operation of the project with any particular river flow. It simply shows what is required and it would be used, and something equivalent was used, but we did not do it on that type of curve. We did it on a load-duration curve of the type that is included in Exhibit 29, one for each [3041] month in the year. We went through a calculation there to show that the project would be dependable with an actual river flow, but we did not feel that that was particularly pertinent to this hearing because this project apparently will never operate with an actual river flow due to the fact that Buggs Island is already under construction and will be completed probably before this project is completed.

Q. So Exhibit 61 is out of the picture entirely, isn't it?

A. No; I wouldn't say it was out of the picture entirely because it does represent an extreme condition. It represents the minimum. Well, no, it

doesn't represent the minimum. It represents the operation that is required and the minimum river flow has been shown to give you that operation. Therefore, that shows that the project is dependable on the load. Now, the rest of the calculation of feasibility has to do with annual output and annual expenses, which was included in Exhibit 15, if I remember correctly.

Q. Now, I appreciate what you are saying, that Exhibit 61 was introduced at a time when there was some discussion as to what capacity the project would have under natural flow conditions.

A. That is right.

Q. Now we do have Buggs Island in operation. Therefore [3042] Exhibit 61, as you correctly stated, on page 2287, represents a hypothetical case of extreme limitations. For example, there may be a breakdown at Buggs Island of some sort as a result of which it would not be possible to regulate the flow and you would have a flow equivalent to natural conditions. Now, I can well see, as you stated, that Exhibit 61 represents an extreme hypothetical condition, unexpected. Now, my question to you is this. In view of that fact, how would you test the feasibility of the project right now with Buggs Island in operation, with Exhibit 61 or with Exhibit 74?

A. Well, I would not use Exhibit 74 because that represents an estimate made by the Army Engineers when they were studying how the Buggs Island project would operate. And that is the only estimate of Buggs Island operation that exists today so far as I know. But it is perfectly true that it may not be

operated exactly that way. But it is the best estimate we have. So by knowing that the project is dependable with the natural flow of the river, certainly the Buggs Island project isn't going to be operated to make the river flow any less. Therefore, the project is dependable on the load.

Q. Mr. Cary, the very purpose of my question, the very purpose of the proceeding, is to determine whether it is dependable upon the load; in other words, whether it does have dependable capacity. Now, you cannot answer my question by stating that you have determined that it is dependable [3043] upon the load and then say that you would use Exhibit 61. I am asking you whether you would use Exhibit 61 in order to test the feasibility of the project, in order to test whether your project has a dependable capacity.

* * * * *

The WITNESS. No; I would not. I would like to explain that a little further. Exhibit 61 represents only the week of the peak load. To determine whether this project is dependable on the system load, I would use the load duration [3044] curves contained in Exhibit 29.

By Mr. HANKIN:

Q. Throughout the year?

A. Yes.

Q. You would not apply your test to the peak week?

A. That would include the peak week.

Q. I see. But I mean the peak week would not be the test of your dependable capacity.

A. The peak week alone would not be the test.

Q. I shall refer you to Exhibit 76 which represents the load curve during the month of April 1954, during the critical river flow year. What is the dependable capacity of that project during that month?

A. 96,000 kilowatts. But that exhibit doesn't show it.

Q. Well, how would you show, by this exhibit, where the greatest amount of capacity obtained is something like 65,000 kw. and it is as low as 25,000 kw.—how would you use that in determining the dependable capacity of the project and show that the dependable capacity is 91,000?

A. That exhibit was not prepared for that purpose. It has no relationship with dependable capacity at all.

Q. Isn't that the capacity that would be available to you in the critical low flow of April 1954?

A. Not at all. I don't think there is any wording on that exhibit that indicates that.

[3045] Q. At any rate, that is the amount of capacity that you would have during that month.

A. No, sir.

Q. Will you read the heading on that exhibit and will you explain what is meant by that exhibit?

A. The heading of the exhibit reads as follows: "Estimated generation and discharge at proposed Roanoke Rapids Project together with existing plant, assuming, (1) operation of Buggs Island as set forth in Exhibit 10; (2) required minimum flow of 2,000 c. f. s.; (3) rate of increase in flow limited to 180

c. f. s. per minute and flow not to be doubled or halved in less than one hour for typical week, April 1954, critical river flow year."

Q. And that exhibit, you say, has nothing to do with the dependable capacity of the project?

A. None whatever.

Q. Now, suppose that we take all of the other months, apart from the peak month, the month of the peak load, how would they enter into the computation of the dependable capacity of your proposed project? Suppose all of them, outside of December, show a curve which is considerably below your 91,000. How would they enter into a showing that the dependable capacity of your project is 91,000 kilowatts.

* * * * *

[3046] The WITNESS. I think I understand the question. If we had drawn curves of estimated operation similar to these exhibits, 72 to 76, for each month of the year, they still would not have shown the dependable capacity. They would have shown estimated operation. Now, to determine the dependable capacity of the project you have to use the load duration curves for each month in the year, which show the variation in peak load on the system. You also have to take into account the variation in capacity, the scheduled maintenance, and determine what part of the system load can be carried by the other sources of power, of which there are many. Then, after that you can determine what this project is required to carry and from that you determine what the expected minimum river flow, in each of those

months, would generate or would make possible at this project. That is quite a long and elaborate study, to determine the dependable capability of a project such as this.

Q. Very well. Let me ask you this question. In testing the dependable capacity of a project, would you test it by the average amount of water available for operation or would you test it by the amount of water available in critical low-flow periods?

A. Well, of course ordinarily you use the critical low-
[3047] flow period. But when a project such as Roanoke Rapids is downstream from a project like Buggs Island, then you have to make estimates of the operation of the upstream project during, well, not only during periods of critical river flow into that project, because with a reservoir the river flow may be above the minimum and yet the release from the project may be somewhat lower for short periods of time. It wouldn't be for extended periods of time, I don't believe.

Q. Isn't your answer, then, that so much more the reason why you should test it in the low-flow period rather than by an average flow period?

A. The low-flow period is the critical test. That is certainly true, generally speaking.

* * * * *

[3084] Q. You were asked on page 2969 of the transcript whether the sales of Buggs Island power to other than utility systems would affect your plan of operation of the project, or its feasibility. Do I understand correctly that your answer to the [3085]

question was in the negative? It is not clear from the transcript.

* * * * *

The WITNESS. I think I can answer that simply. The answer is in the negative. It would not affect the feasibility. By saying it would not affect the plan, I meant the general plan. I did not mean it would not affect some of the details.

By Mr. HANKIN:

Q. Do I understand, then, that irrespective of these sales, you would still actually operate your project in accordance with the load pattern in Exhibit 74?

A. I certainly did not mean that.

Q. Did I understand that the feasibility of the project would not be affected whether the Buggs Island power was sold to utility systems or to others?

A. I don't think you are quoting me quite correctly there. The question asked me was this, would such sales to such Federal [3086] agencies as listed by Mr. Creim——

Q. Affect your plan of operation of the project, or its feasibility?

A. It would not affect the general plan of operation or the feasibility.

Q. In other words, the answer is no. There was no need, then, for the statement made by you on page 456 of the transcript that you had assumed all through your studies that the power output from Buggs Island would be used to supply utility systems of some sort, and that on that assumption you were not worried at all about the releases of water from Buggs Island; is that correct?

A. That is a correct statement.

Q. Why did you make it?

A. It is the fact.

* * * * *

[3088] Q. First of all, on page 456 of the transcript you assumed that all through your studies the power output from Buggs Island would be used to supply utility systems of some sort, and that on that assumption you stated you were not worried at all about the releases of water from Buggs Island?

A. That is right.

Q. Now, I am asking, didn't you have to make that asumption in order to take advantage of the regulated flow from Buggs Island which would benefit the operations of Roanoke Rapids?

A. I don't like that question. I can answer it, all right.

Q. Well, answer it.

A. You can't give a yes or no answer to that.

CHIEF PRESIDING EXAMINER. Well, answer it, if you understand the question.

The WITNESS. Naturally Roanoke Rapids can't operate without water. I had to assume some operation of Buggs Island. We naturally assumed that it would operate to serve utility loads. The Flood Control Act of 1944 in general terms states that it shall be used in such a way as to promote the most widespread use, I think is the term. Now, my testimony in there, in the early part of this case, was to the effect that any operation under that general specification would be entirely satisfactory to the operation of

Roanoke Rapids. We are not dependent on Roanoke Rapids on any regulated flow from Buggs Island. We can [3089] use any flow that they are liable to release in carrying out the general terms of the provisions of the Flood Control Act of 1944. That was what I was trying to state.

By Mr. HANKIN:

Q. Now, in Exhibit 87 it was shown that if you do not have special regulation for Roanoke Rapids, you would not have the capacity that you say you would. * * * And therefore you stated that that wouldn't make any difference, you don't need any special regulation, that you could get by with whatever water is released, is that correct? * * * Now, my question is didn't you have to make the assumption that the water would be released in such a way as to serve some utility systems, and that therefore you were not dependent upon special regulation of Buggs Island?

* * * * *

[3091] Q. Did you understand the question, Mr. Witness?

A. I am not sure that I do.

Q. Let me explain, because I think we can get along very much better if I explain.

Mr. Cary, you will recall that Mr. Hamilton has testified to the effect that for Roanoke Rapids to be feasible it would be necessary to have a firm contract with the Secretary of the Interior to assure the releases of water necessary for the operation of Roanoke Rapids. Do you recall that?

A. I recall his testimony very well.

Q. And you testified on page 456 in opposition to that contention that that sort of a contract would not be necessary at all, because, if you will refer to page 456 of your testimony, you said, "We have always assumed that Buggs Island power would be used to serve, to supply some utility systems, or to supply utility systems of some sort," and that on that assumption you were not worried at all about the releases of water from Buggs Island.

[3092] A. That is correct; I said that.

Q. Now, then, the question that I am asking you now is this: isn't that an assumption that you had to make in order to be able to take advantage of the regulated flow from Buggs Island without having to go into a contract to regulate the water for you?

A. I had to assume that Buggs Island would be operated in accordance with the Flood Control Act of 1944, which in general terms means that it will be operated largely to supply some sort of utility systems, private, municipal, REA—it doesn't make any difference. I had to assume it would operate that way, but I did not have to assume it would put out any specific regulated flow that I had to have in order to make Roanoke Rapids operate.

Q. So your answer is that you had to make that assumption——

A. What assumption?

Q. That the Buggs Island project would be operated to supply utility systems of some sort.

A. Right.

Q. And isn't that the assumption that was made throughout Exhibit 29, where both Buggs Island power and Roanoke Rapids power were put on the load curve of the VEPCO system?

A. That is almost correct. I would like to explain a little difference there.

[3093] The operation of Buggs Island—that is, the output from Buggs Island was assumed to be the same as contemplated in Exhibit 10, the Project Report. Then in Exhibit 29 we applied that monthly energy to the system load of the Virginia Electric and Power Company.

Q. And that is a more specific assumption, is it not? You said that the water would be released to supply the needs of utility systems of some sort, whereas Exhibit 29 assumes that the water will be released to supply the needs of Roanoke Rapids itself, or VEPCO's system, I should say?

A. No; the operation of Buggs Island as contemplated in Exhibit 10 is not necessarily the way it would be operated for the best use of the Virginia Electric and Power Company system load. It may be, it may not. We haven't checked that.

Q. Don't the curves in Exhibit 29 show that the power from Buggs Island is supplie to the VEPCO load?

A. Oh, yes.

Q. Now, after Exhibit 87 was introduced, you stated that it does not make any difference whether the Buggs Island Reservoir is operated to meet the needs of some public utilities, of some utility system,

because the load of the customers of the Southeastern Power Administration would not be substantially different from utility system loads; is that correct?

A. That is right.

Q. How do you know that is so, Mr. Cary?

[3094] A. I am reasonably familiar with the loads that Mr. Creim referred to, and the effect of the loads in that general area that would be supplied if the energy was sold to the preferential customers.

* * * * *

[3096] By Mr. HANKIN:

Q. Mr. Cary, can you state what would be the load factor at which Buggs Island power could be sold the NACA?

A. No; I cannot.

Q. You don't know it?

A. Don't know.

Q. Can you state what would be the load factor of each of the Federal agencies given by Mr. Creim on pages 2582 to 2584 of the transcript?

A. No; I don't know.

Q. Can you state what would be the load factor of each of the public agencies in North Carolina listed by Mr. Creim on pages 2601 and 2602 of the transcript?

A. No; I don't know.

Q. Can you state what would be the load factors of [3097] the public bodies in Virginia as given by Mr. Creim on page 2617 of the transcript?

A. No; I don't know.

Q. Can you state at what load factor the Old Dominion Electric Cooperative would purchase power from Buggs Island?

A. No; I don't know that either.

Q. Can you state at what load factor the North Carolina cooperatives will purchase power from Buggs Island?

A. No.

Q. Do you know how much power would be delivered from Buggs Island project during the night hours and on Saturdays and Sundays?

A. No.

Q. Considering, as appears on Exhibit 85, that the potential preferred customers of the Southeastern Power Administration will have 291,450 kw. of their own capacity, of which 277,250 kw. will consist of fuel capacity, and that Southeastern may use some or all of this fuel capacity in order that greater benefits might accrue to both the buyer and the seller, can you state at what load factor Buggs Island power will be furnished to these customers?

A. No.

Q. If you do not know the answers to all of these questions, how can you make the statement that the loads of these customers supplied from Buggs Island project would not [3098] be substantially different from the utility-system loads?

A. That is my best judgment based on my knowledge of the general type of load of that group of customers.

Q. But you do not have any data upon which you could base that conclusion?

A. No statistical data; no. Just my general operating experience and knowledge of those loads.

Q. You state on page 2969 of the transcript that the utility system loads are made up partly of such loads. Aren't you then talking only about a part of your load and not your entire load?

A. That's correct.

Q. On page 162 of the transcript you testified that the 11 REA cooperatives in Virginia and the 17 REA systems in Eastern North Carolina had a combined load factor of 36 per cent; that diversity of loads on such a widespread group of systems would undoubtedly result in an annual load factor for the group as a whole of at least 40 per cent. Is that correct?

A. That's correct.

Q. Now, with sales of power made to the NACA and with the use of the capacity, the fuel capacity, owned by the potential customers, wouldn't the load factor at which power is sold from Buggs Island be less than 40 per cent?

A. It would depend upon the river-flow conditions [3099] in the year under consideration. It would be less than 40 per cent in a critical river-flow year. In an average river-flow year it would be more than 40 per cent.

Q. What is the load factor of the VEPCO system on an annual basis?

A. That is shown on Exhibit 19. In 1948 the system load factor was 55.5. It is estimated that in

the future years up through 1954 that it will be approximately 56.

Q. Would you say that the difference between 40 per cent and 56 per cent is not a substantial difference?

A. No; I'd say that was a substantial difference.

Q. If Old Dominion supplies part of its load from its old steam plant and purchases the remainder of its power from Buggs Island, might not the load factor of its purchased power be considerably less than 40 per cent, and might it not vary from time to time?

A. It would vary.

Q. You say on page 2969 of the transcript that the hour-to-hour operation of Buggs Island is of no significance in the operation of Roanoke Rapids because, and I'm quoting, "the Roanoke Rapids pond has ample storage capacity to regulate flows which such sales would create." How much power storage do you contemplate using in Roanoke Rapids during the critical periods of——

* * * * *

[3100] The WITNESS. I can't answer that exactly. My recollection is that it would be about one foot. I know it's considerably less than three feet.

By Mr. HANKIN:

Q. Perhaps I can recall to you that on page 1690 of the transcript you testified as follows: "Calculations made for us by Charles T. Main, Inc. show that the maximum daily use of the pondage at Roanoke Rapids under normal operating conditions would re-

sult in a draw-down of less than three feet, with daily recovery. For average and low flow conditions they found that the average draw-down would be about one foot." Is that correct?

A. That was the way I remembered it but I wasn't positive.

Q. Now, after Exhibits 79, 80, 81, and 87 were introduced, you criticized them because they assumed a drawn-down of two feet, giving 5,000 c. f. s.-days of storage. And you stated on page 2984 of the transcript that it would be, and I quote you, "entirely practicable to draw the pond down as much as five feet and still maintain a capacity of 91,000 kw."

My question to you is this: Does this mean that you would operate your project at a draw-down of as much as five [3101] feet rather than an average of one foot during the average and low-flow periods as you testified before Exhibit 79, 80, 81, and 87 were introduced?

A. It doesn't mean that at all. I simply stated that it could be drawn down five feet.

Q. But you didn't contemplate doing it?

A. No.

Q. Wouldn't it follow that if you operated your reservoir with a draw-down of as much as five feet you would get less power with the same amount of water because you would operate at a lesser head?

A. You would get less but not necessarily less than 91,000. It would depend on the hydraulic design of the plant. My hydraulic engineers have

informed me that it would be entirely practicable to design it that way.

Q. For the same amount of water, with the same design, would you get less power?

A. I didn't say anything about the amount of water. I said you could get the same capacity with the lower head. Actually that would require more c. f. s. per kilowatt.

Q. Yes; but when you draw down your reservoir for the same design, for the same amount of water, would you get less power?

A. You would get less energy.

Q. If you get less energy, then you get less power, [3102] don't you?

A. No, sir; that doesn't follow. Power and energy are two different things.

Q. How would the power be affected by a draw-down of the reservoir?

A. The power would be less.

* * * * *

Q. Would be?

A. But not necessarily less than 91,000. It depends upon your design.

Q. You mean if you have a plant designed with a capacity of 91,000 and you get less power, you wouldn't get less than 91,000 kw.?

A. You can design a project to do a number of different things. The project could be designed to give 91,000 kilowatts with a draw-down of five feet. Then it would naturally follow that when you had a full pond you would get more capacity.

Q. I see. And is your proposed project designed to get more than 91,000 kw. with a full pond?

A. The detailed designs have not been completed. The only thing I can do is tell you what our engineers have told me.

Q. What have they told you?

[3103] A. They have told me it could be designed to give the 91,000 kilowatts with a drawdown of five feet.

Q. But that is not part of the application?

A. Not part of what?

Q. Of the application. In the application you stated that you are proposing a project with rated capacity of 91,000 kw.

A. I'm not sure that I can answer that. I'm not sure I know exactly what those statements in the application mean. The hydraulic engineers handled that phase of it.

Q. Aren't you one of the engineers?

A. I'm not a hydraulic engineer. I have nothing to do with the design of the plant.

Q. Now, perhaps this question will make it more clear. If you want to get capacity of 91,000 kw. and you draw down your pond by as much as five feet, don't you then exhaust your power capability and aren't you then entirely dependent upon the releases from Buggs Island without any ability on the part of Roanoke Rapids project to supplement those releases?

* * * * *

[3104] The WITNESS. No.

By Mr. HANKIN:

Q. How would your pondage or storage help you if you have to supplement your releases from Buggs Island if you have drawn down your pool?

* * * * *

A. Well, maybe I didn't quite understand your question properly. It's perfectly true that the Roanoke Rapids project is going to use the water that is released from Buggs Island. There's no getting around that fact.

Q. And if you draw down your pool by as much as five feet, you have nothing to supplement that flow with.

A. Well, I assume that we will always be getting at least the natural flow of the river.

Q. Well, whichever way that is. As a matter of fact, [3105] with Buggs Island in operation, you are getting much more than the natural flow, aren't you?

A. That's expected.

Q. Yes. Now, if you draw down your pond do you have anything to supplement that storage in case you need it?

A. I think I understand you. You have only the inflow to the Roanoke Rapids project.

Q. That's correct. Now, do your think that that would constitute sound operation to draw down that pond by five feet?

A. It would depend upon the conditions. It might.

Q. Under what conditions would it be sound operation and under what conditions would it not be?

A. Well, I think it might be entirely sound operation to operate that way if the inflow to the Roanoke

Rapids project was such as occurred in December 1917, during the latter part of December, when you know you're having your extreme peaks which will be followed by a decided reduction in load, during which time you could recover the elevation in the Roanoke Rapids pond.

Q. But that would require prophecy on your part, wouldn't it, and not engineering operation?

A. Well, I think it would be engineering operation.

Q. To foresee the future?

A. Well, of course, we don't have any crystal balls [3106] that do us any good, but we have past experience that helps us quite a lot.

Q. And how does past experience help you in what will be the flow in the next few days?

A. I don't think a few days comes into it. I think it's more than that. You must take a longer period of time than a few days.

Q. I see. All right. From your testimony on page 2984 I take it that you think that Exhibits 79, 80, 81, and 87 are defective because the maximum amount of storage given there is 5,000 c. f. s.-days. Is that correct?

A. No.

Q. Let's turn to page 2984 and see what you said about it.

A. 84?

Q. Yes; 2984. Perhaps I am mistaken. On page 2984 the question was asked: "On Exhibits 79, 80, 81, and 87 there is a figure for storage given. It is given in the maximum amount of 5,000 c. f. s.-days.

Is that the correct figure for the total amount of storage at the Roanoke Rapids project?"

The answer is: "No, it is not. 5,000 c. f. s.-days is only storage in the top two feet of the pond, approximately."

Then comes the question: "What is the total amount of usable storage?"

[3107] And then will you read what you answered to that question?

A. You want me to read from the transcript?

* * * * *

Mr. HANKIN. I'll read it. "It would be entirely practicable to draw the pond down as much as five feet and still maintain a capacity of 91,000 kilowatts. The top five feet of the pond contains a storage of approximately 10,600 c. f. s.-days." Isn't that what you answered?

* * * * *

The WITNESS. I don't understand the relation between that and the question you asked me.

By Mr. HANKIN:

Q. The question I asked you is: From your testimony on page 2984, is it not true that you said Exhibit 79, 80, 81, and 87 are defective because the maximum amount of storage given there is 5,000 c. f. s.-days?

A. You're not reading correctly from the transcript.

Q. No, no. That was my question to you. That is my question.

A. I didn't say it was defective for that reason.

Q. What was the import of that statement on page [3108] 2984? Did you mean to say that, "Why, yes, these exhibits used 5,000 c. f. s.-days very correctly, but for your general information I would like you to know that we can draw down the storage by as much as five feet"?

A. The question on page 2984 asked me was this, and I read from the transcript: "Is that the correct figure for the total amount of storage at the Roanoke Rapids project?" And I said it was not. I said nothing about those exhibits being defective for that reason.

Q. You mean that part of your answer given on lines 7 and 8 of page 2984 was not related to what—you mean that that part of the question was not related to what was asked on lines 5 through 7 on the same page?

* * * * *

[3109] By Mr. HANKIN:

Q. Well, Mr. Witness, do you think that Exhibits 79, 80, 81, and 83 correctly use a pool storage of 5,000 c. f. s.-days, usable storage of 5,000 c. f. s.-days?

A. Read that, please.

* * * * *

The WITNESS. I don't think I can answer that question directly because the use of storage as contemplated in those exhibits is based on certain assumptions. I think I'm corect in saying that in most cases I don't think the assumed storage of 5,000 c. f. s.-days was correctly used. There were one or two cases there where it looked like some attempt was made to use it properly but in most cases no.

By Mr. HANKIN:

Q. As an engineer qualified to testify on this subject, how much more capacity do you think you would obtain in critical periods if your usable storage were 7,166 c. f. s.-days instead of 5,000 c. f. s.-days when used in connection with [3110] Exhibits 79, 80, 81 and the lower part of 87?

A. I would never use those exhibits for any purpose whatsoever.

Q. But assuming that you did, how much more capacity?

A. I wouldn't know how to use them. They're based on such erroneous assumptions they have no meaning to me whatsoever.

Q. Will you state what are the erroneous assumptions?

A. I'll be glad to.

Q. Very well.

A. The erroneous assumption in all four of those exhibits was the assumption that the project had to operate on the load pattern shown in Exhibit 74 in order to be dependable, and, as I stated before, there is no basis for that assumption whatsoever.

* * * * *

Q. Let's have all the assumptions. What else is there erroneous?

[3111] A. Well, I don't know what else is wrong with them except in some cases there they looked like they did not properly use what storage was there—I mean what storage they assumed was there.

Q. Can you point to the places where the storage that was available was not properly used?

* * * * *

[3112] CHIEF PRESIDING EXAMINER. If it is going to take an unreasonable length of time for you to locate it, we will consider that——

The WITNESS. To answer that question completely would take time. I may illustrate by reference to one exhibit. I think I recall that.

CHIEF PRESIDING EXAMINER. Of course, if you had the facts ready at your tongue's end and could just let us have it, I would be glad for you to answer.

The WITNESS. I don't think I can say I have them right on the tip of my tongue because it would take some restudy of these exhibits.

* * * * *

[3113] Q. Now, Mr. Cary, under any operation don't you figure that if you do draw down the storage in critical periods to generate power you will have to return that much water into storage in order to be able to start your operations on the following Monday with full reservoir, with a result that you will not be better off if you use 7,166 c. f. s.-days than if you use 5,000 c. f. s.-days?

* * * * *

A. Read that.

The WITNESS. I would like to be sure I understand it. [3114] Would you read it?

The WITNESS. I just don't understand the intent of the question.

By Mr. HANKIN:

Q. Perhaps I can make it clearer by saying this: Under any kind of an operation—I don't care whether you take Exhibit 74 or any other pattern of operations—when you let water out of the reservoir don't you have to return water to the reservoir in order to start with a full reservoir on Mondays?

A. I don't know that it's absolutely essential that you start with a full reservoir on every Monday morning. That is desirable, of course.

Q. It's desirable, isn't it?

A. Yes.

Q. And, as a matter of fact, if you want to make sure that you will have enough water to operate in accordance [3115] with whatever pattern you want, you want to take advantage of a Saturday and a Sunday and you want to keep enough water in the reservoir so as to start with a full reservoir on Monday.

Now, if you use the reservoir on a draw-down of three feet, which will mean 7,166 c. f. s., would you be any better off than if you used a draw-down of two feet which will give you 5,000 c. f. s.-days—considering the fact that you have to return the water to the reservoir in order to start with a full reservoir on Mondays?

A. I don't think I can answer and say whether I would be better off or not. It may be that the load conditions which required me to draw down three feet, if it did, might have made it so I would be better off if I drew down the three feet. It's perfectly true that if I draw down the three feet it

would take more water to get you back to full pond after you did it, but you may not be any worse off. Maybe your load conditions in the following week and the flow conditions might make it so you were better off by having done that.

Q. I see. Now, assuming that you are going to follow a pattern like the one in Exhibit 74, would you be any better off if you used a draw-down of three feet than if you used a draw-down of two feet?

A. I have an awful difficulty following what you are [3116] really aiming at. I mean I don't understand the significance of the question or what's really intended.

Q. Perhaps if I told you what's in my mind it wouldn't be as clear as the question by itself. After all, it's a simple question that I am asking. Here you draw down water. You have to refill the reservoir. And the question is: Would you be better off with a draw-down of three feet than of two feet when you operate in accordance with the pattern of Exhibit 74 which you stated is what you expect the actual conditions to be?

A. You're tying so many things together that are not related that I don't consider that an intelligent question.

Q. Very well, Mr. Cary. On your Exhibit 92 you have in the cross-hatched area your Exhibit 74, do you not?

A. That's right.

Q. All right. Now, suppose you operate your project in accordance with that exhibit, in accordance

with that Exhibit 74 as you have it on Exhibit 92. And all I am asking you is whether a draw-down of three feet—that with a draw-down of three feet you would be able to obtain any advantage as compared with a draw-down of two feet.

* * * * *

[3117] The WITNESS. I can answer that question. The answer to that question is "no," but I would like to explain by stating that if the operation were as indicated by Exhibit 74, the inflow to the Roanoke Rapids project would average—I think the figure was approximately 7,700 c. f. s.—and under that condition of operation I don't think there would be any occasion for drawing the pond down as much as three feet.

By Mr. HANKIN:

Q. Now, suppose you have a critical period. Would there be any occasion to draw down the reservoir by three feet?

A. You mean by that that if the inflow to the Roanoke Rapids project were the same as the natural flow of the river in critical flow periods?

Q. Whatever they may be. Suppose you have a critical low-flow period. Would you be better off by operating your usable storage at three feet than at two feet?

Mr. GIBSON. With what inflow?

The WITNESS. With what inflow to the Roanoke Rapids project?

[3118] By Mr. HANKIN:

Q. Well, let's suppose we have the natural flow conditions.

A. Under the critical low-flow conditions?

Q. Yes.

A. I can't answer that.

Q. Mr. Cary, what do you understand to be the significance of Exhibit 80 concerning which Mr. Hamilton testified?

A. You mean what I think the significance is?

Q. Yes.

A. None whatever.

Q. You mean there was nothing that Mr. Hamilton tried to show by Exhibit 80——

A. You mean what I think he was trying to show or what I think it shows?

Q. Yes; exactly. What did he try to show by it?

A. Oh, what he was trying to show——

Q. After all, you criticized it, didn't you?

A. I certainly did.

Q. You objected to it. You must have understood——

* * * * *

[3119] The WITNESS. I think I can answer it.

CHIEF PRESIDING EXAMINER. Very well; go ahead.

The WITNESS. It is my opinion that what Mr. Hamilton was trying to show by Exhibit 80 was that some of the 91,000 kilowatts of capacity at the Roanoke Rapids project was furnished by the Buggs Island project.

By Mr. HANKIN:

Q. Is that all? In what way is Exhibit 80 different from Exhibit 81?

* * * * *

[3121] By Mr. HANKIN:

Q. Mr. Witness, will you say what is the content of Exhibit 80 according to your understanding of it?

A. I will repeat again that it's my understanding that Mr. Hamilton put in Exhibits both 80 and 81 to show that Buggs Island contributed to the dependable capacity of the Roanoke Rapids project. Exhibit 80, he assumed that Roanoke Rapids had to operate exactly in accordance with the operation shown on Exhibit 74. And in running through that operation with the critical low flows in December, he naturally ran out of water and pulled the pond down at Roanoke Rapids to the full extent of the 5,000 c. f. s.-days of storage which he assumed. Then from that time on Roanoke Rapids operated only on the inflow to the pond except over week ends he got some recovery of pondage but not enough.

He was aware of the fact that that was an impractical operation so then he worked up Exhibit 81 in which he esti-[3122]mated an operation parallel—what he calls parallel to Exhibit 74. That is with the same shape of load pattern but much less actual generation. And then he ran through that operation, and I don't know that he did a good job of getting a proper load pattern even at that, because he ran out of water down about the middle of the month, used up all the pondage that he assumed was there.

If he had done the job properly, he would have found out what load pattern he could have carried. But what the intent of both of those exhibits was was to show that Roanoke Rapids could not operate on

the load pattern of 74 with those critical low flows. There has been no claim that it could operate on that load pattern. There is no necessity for it to operate that way with those flows. And the whole objection to those two exhibits goes back to that false assumption that in order to be dependable the project had to operate as contemplated in Exhibit 74. There is no basis for that assumption.

Q. Well, whichever way it is, Mr. Cary, is it not true that we assume, rightly or wrongly, that under the critical low-flow periods you would operate in accordance with Exhibit 74? That on Exhibit 80 we try to operate in accordance with Exhibit 74 exactly and we ran out of water? And in column (s) of that exhibit we showed the deficiency in the capacity, saying, in other words, that if Exhibit 74 [3123] is correct then that much capacity has to be contributed by Buggs Island? Isn't that so?

A. That's what he was trying to do.

Q. Now, the draw-down used in Exhibit 80 is two feet or 5,000 c. f. s. Is that right?

A. That was what he assumed.

Mr. HANKIN. If your Honor please, I should like to have an exhibit marked for identification as "80–A." It is entitled "Average Daily Capacity Furnished by Buggs Island During a Critical December Month (Dec. 2, 1917–Jan. 1, 1918) With Usable Storage of 7166 c. f. s.-Days." I would like to have that marked for identification as "Exhibit 80–A."

CHIEF PRESIDING EXAMINER. It will be so marked for identification.

* * * * *

[3124] By Mr. HANKIN:

Q. Mr. Cary, I invite your attention to Exhibit 80–A marked for identification. If you follow me, Mr. Cary, you will see that in this exhibit the drawdown assumed in Column (b) is three feet, or 7,166 c. f. s.-days, and the method pursued in this exhibit is the same as that pursued in Exhibit 80, all the other differences between these exhibits being attributable to the additional storage.

* * * * *

Q. You will note, Mr. Cary, that here also the reservoir is exhausted after the first day of operation except for inflow over the week ends. Do you see those points that I mentioned? [The witness nodded affirmatively.].

Q. Now comes my question. Now, Mr. Cary, will you look back at Exhibit 80 and note the maximum figure in [3125] Column (s) in that exhibit? What is it?

* * * * *

A. The largest figure in Column (s) is 83,700.

* * * * *

[3126] Q. And that is present for both December 14 and December 28; is it not so?

A. That appears to be correct.

Q. Now, will you turn to Exhibit 80–A. Don't you find that the maximum figure is the same for the same days?

* * * * *

(Objection sustained.)

* * * * *

[3134] Mr. HANKIN. If your Honor please, I have offered Exhibit 80–A in evidence while cross-exam-

ining this witness. You may exclude it if you want to but the offer is there.

CHIEF PRESIDING EXAMINER. It is not the time to offer it during your cross-examination of this witness.

* * * * *

[3136] Mr. HANKIN. I should like to ask that an exhibit entitled "Capacity of the Proposed Roanoke Rapids Project with and without Buggs Island during the Critical Month of December (with Usable Storage of 7166 c. f. s.-days)" be marked for identification as "Exhibit No. 81–A."

* * * * *

[3140] Q. Subject to check, Mr. Witness, I wish to call to your attention that Exhibit 81–A marked for identification is analagous to Exhibit 81 except that it assumes 7,166 c. f. s.-days rather than 5,000 c. f. s.-days as assumed in Exhibit 81.

Now, will you please note the maximum figure in column 10 of Exhibit 81 for December 14 and December 28. What is it?

A. 83,700.

Q. What corresponding figures for those days do you find on Exhibit 81–A?

[Objection sustained.]

* * * * *

[3141] Q. Now, Mr. Cary, in all exhibits, whether you take 80, 81, 80–A, or 81–A, the contribution of Buggs Island to the dependable capacity of Roanoke Rapids, operated in accordance with the load pattern in Exhibit 74, is 83,700 kw., is it not?

[Objection sustained.]

* * * * *

Q. Now, Mr. Cary, will you please state whether you are still of the opinion, if you ever were of one, that the use of 7,100 c. f. s.-days rather than 5,000 c. f. s.-days makes any substantial difference in the results shown by Exhibit 80 and 81?

A. If it would make any difference?

Q. Yes.

A. I don't think it would.

* * * * *

Q. Mr. Cary, on page 2970 you testified that with releases of water amounting to 7,030 c. f. s. or over, you would be able to [3142] operate the project in accordance with the load curve in Exhibit 74; is that correct?

A. That is right.

Q. Then you were asked whether in the critical period you would be able to operate the project at its full capacity of 91,000 kilowatts in the manner described in Exhibit 61; is that correct?

A. Is it correct that I was asked that?

Q. Yes.

* * * * *

CHIEF PRESIDING EXAMINER. Do you understand the question, Mr. Cary?

The WITNESS. I am not sure I do. I am trying to identify what is in the record.

By Mr. HANKIN:

Q. The question beginning with line 9 through line 16.

A. I have read the transcript. Now, what is your question?

[3143] Q. Whether you would operate the project on natural flow conditions in the critical month, whether

that would permit you to operate the project as described in Exhibit 61:

A. It would permit us to operate in accordance with that exhibit.

Q. I believe you referred to Table 4 in the report as giving an average of 7,030 c. f. s. for December. Can you tell what percent of the time you would get this average flow in December?

A. The average for the entire month.

Q. What percent of the time, you would get an average flow of 7,030 c. f. s.?

A. Exactly that amount, you mean?

Q. Or over it.

A. I don't know. I only know that the average for the month is that, or would be that under the assumption made there.

Q. Now, when you do not have an average flow of as much as 7,000, in round figures, would you operate according to the load curve in Exhibit 61?

A. You said when I do not have as much as 7,000, would I operate in accordance with 61?

Q. Yes.

A. I don't think that question can be answered. It is not susceptible——

Q. If you got enough water to operate the project in accordance with your load pattern in Exhibit 74——

[3144] A. You said 61. I thought you made a mistake. That is why the question didn't sound right. Did you mean 74?

Q. The first question was whether you would operate in accordance with Pattern 74 if you had 7,000 c. f. s., and you said yes.

A. That is right.

Q. Now, suppose you don't get the amount of water available, you have less than 7,000 c. f. s., would you then operate in accordance with the pattern as shown in Exhibit 61?

A. Not necessarily.

Q. You say not necessarily. What kind of load pattern would you operate under?

A. I don't know how much flow you are talking about.

Q. Well, in other words, you would operate, shall we say, on some pattern which is somewhere between Exhibit 74 and Exhibit 61?

A. That is correct, that is exactly what we would do.

Q. In other words, you would narrow the operations, you would narrow the curve so that you would have 91,000 kw. for less time; is that correct?

A. I think that is a fair way of stating it. I like the other way of stating it better, that I would operate it higher on the load curve, which would require less energy to make the full capacity dependable on the load.

Q. What I want to bring out is this. If you have that [3145] amount of capacity, 91,000, you would narrow the time during which you had that capacity; is that correct?

A. I would narrow the time when that capacity is needed on the load curve.

* * * * *

[3158] Q. Have you Exhibit 92 before you?

A. I have it before me.

Q. I would like to ask you whether I understand this exhibit correctly. Do I understand correctly that the generation represented by Exhibit 74 is shown on your load curve for December by the cross-hatched area; is that correct?

A. It is the cross-hatched area in both places in the upper part of the curve, as well as the lower part of the curve, and in addition to that, the area below the solid line, horizontal line across the bottom of the chart, which indicates the 5,300 kilowatts from the minimum release.

Q. But the peaking part is represented by the cross-hatched area?

A. That is correct. On Exhibit 74, though, it was all in one place.

Q. And that represents the operation of the Roanoke Rapids project when there is sufficient water available; is that correct?

A. When there is water available to make that operation practical; that is right.

Q. When you do not have a sufficient amount of water available, namely during a critical December, you move up the operation of the Roanoke Rapids project to the very top of the curve, and the operations represented by solid black areas which correspond to Exhibit 61; is that correct?

[3159] A. I didn't like one part of your question. You said when we don't have sufficient water. Do you mean when we have less water?

Q. Yes. Now, when the water is not available for operation on the load curve in Exhibit 74, and the

operation is moved to the position shown by Exhibit 61, what takes the place of the operations in the cross-hatched area?

What I mean is, what do you use to produce the power represented by the cross-hatched area?

* * * * *

The WITNESS. The principal difference between the operation there as shown in the cross-hatched area and in the solid black area is simply in the amount of energy available from the project.

When operating in accordance with the load pattern of Exhibit 61, as indicated by the solid black, the same amount of capacity is obtained from the project as indicated by the cross-[3160]hatched area. The only difference is the energy or the hours used, and when there is less water, and the hydro project generates less energy, the steam plants and other sources of power for the system generate more energy and make up the difference.

Q. Well, now, will you please answer my question?

A. I thought I had. I was trying to answer your question.

Mr. HANKIN. Miss Reporter, would you please read my question so that we will have an answer to it?

(The question was read.)

* * * * *

The WITNESS. I still think I answered that question.

By Mr. HANKIN:

Q. What equipment do you use? Do you use steam equipment?

A. You require no more steam equipment or other source of power when you are operating in accordance

with the pattern of 61 shown in black than when you are operating in the pattern shown for 74, which is cross-hatched, which simply results in the hydro project taking a different position on the load curve, and the same steam equipment operates in both cases.

In the one case the hydro project puts out more energy—that is like the 74 case—and the steam equipment will put out less energy. When there is less water available and the hydro project operates at the top of the load curve in accordance with 61, then that same steam equipment carries the rest of the load and simply generates more energy.

[3161] Q. I take it you don't understand the question. Here on Exhibit 92, first of all you have a load curve, and the area bounded by that curve, below, represents your operations; is that correct?

A. The area represents the energy.

Q. Yes; the area represents the energy. Now, when you have enough water available, the area represented by the cross-hatched lines represents the energy produced by the hydro plant?

A. That is correct.

Q. Now, there comes a time when you do not have enough water available so instead of operating your hydro plant in the cross-hatched area, you move it up to the black areas, Exhibit 61. Now, you must have something that would supply the energy in that cross-hatched area at that time? What do you use?

* * * * *

[3162] The WITNESS. I still feel like I have answered that question twice. I have stated that the difference in energy is supplied from the steam stations.

By Mr. HANKIN:

Q. You would then use steam equipment, would you not?

A. I would use the same steam equipment that I was using as if I were operating on the cross hatched area pattern.

Q. Well, yes, no doubt, but at that time, at other times, we will say, the hydro project occupies that area. Now, when we move the hydro project up to the black lines, then you will use steam equipment to occupy the cross hatched area, will you not?

A. The same steam equipment that was occupying the black area before. They just interchange positions. If the movement——

CHIEF PRESIDING EXAMINER. But you do use steam.

The WITNESS. But I am trying to bring out the fact that [3163] it is the same steam in both cases. It simply means more hours use of the steam equipment to generate more energy, but no more capacity [i. e. steam generating equipment] is required. That is the point I am trying to make very clear, because that is the important point here.

By Mr. HANKIN:

Q. If you have additional capacity, why do you need it?

A. I didn't say anything about additional capacity. I said the same capacity.

Q. If you have all the capacity you need to operate on that peak, why do you need the project?

* * * * *

The WITNESS. I can explain that, if you want to take the time. It is getting elementary.

* * * * *

[3164] The WITNESS. If we were operating in accordance with the load pattern, as I have said before, in the cross-hatched area, the steam capacity required would be that peak of 720, which is the peak on the system, less the 96,000 kilowatts that is being generated by the project and the existing plant. In other words, the amount of steam equipment, or steam and other sources of power that we will assume for the sake of this argument is all steam—the amount of other capacity required will be 624,000 kilowatts. Do you follow me on that?

By Mr. HANKIN:

Q. Yes.

A. All right, now, if there is less water available all the way down to the amount that would require the project to go up and operate in accordance with the load pattern of 61, and the hydro project were put on the peak of the curve, the hydro project would still be carrying the same 96,000 kilowatts, as indicated there on that exhibit by the fact that it carried the load above 629,300 plus the 5,000 from the minimum flow at the bottom.

Q. 5,320?

A. 5,320. Now, what it was carrying there above the 629,300 is the 90,700 that I have referred to on a number of occasions, plus that 5,300 down at the base, is the same 96,000.

Now, that 96,000 subtracted from the 720 gives you that same 624, which shows that the amount of other capacity required for this operation is exactly the same. The only difference is the [3165] hours of operation.

Q. Yes, in other words——

A. And the energy output.

Q. In other words, what you would do is this. When you have moved up your hydro project, you would use steam capacity, a steam plant?

A. When you move the hydro project up, some of the steam moves down, if you want to put it that way, but it is the same amount of steam capacity.

Q. But in the cross-hatched area you have steam equipment capacity available all the time in order to carry that load.

A. Under what condition?

Q. Whenever you move up your project, the hydro project, when it can't operate on the pattern in Exhibit 74.

A. You have got to have the steam capacity available all the time anyhow, regardless of which way you operate the project. You can't get more than 96,000 kilowatts out of the project, so the rest of the load has got to be supplied from some other source. It doesn't make any difference how much water you have got available.

Q. Then, Mr. Cary, I would like to ask you this. Does it not mean that in order to take care of the cross-hatched area of the load all of the time, VEPCO has to have a double investment, about $300 per kw.

hydro, and about $100 per kw. in steam, if an old plant is used, or $129 per kw. if a new steam plant is [3166] used, as you testified on page 136 of the transcript; is that correct?

* * * * *

The WITNESS. It seems to me you have about three questions wrapped up in one. I can say absolutely there is no double investment. Now, your question there about the old plant vs. the new plant, I would like for you to make that clearer.

By Mr. HANKIN:

Q. Well, what would you use in that cross-hatched area when you can't operate according to Exhibit 74? Would you use a new plant or an old plant?

A. I would use the same steam equipment that I was using if I were operating on 74.

Q. Which is that, a new plant or an old plant?

A. A combination of both.

Q. And then in order to take care of the cross-hatched area 100 percent of the time, don't you have to have a double investment?

A. No.

* * * * *

[3167] Q. Is it not true, Mr. Cary, that in order to take care on the cross-hatched area you would have to have an investment of approximately $40,000,000 whereas with a steam plant you are assured of the same power with an investment of only $13,000,000?

* * * * *

The WITNESS. You will have to explain that question. It just doesn't make sense to me.

[3168] By Mr. HANKIN:

Q. I shall be very glad to explain it to you. You have an investment—we are now talking in round figures—of $27,000,000 in hydro plant. That hydro plant ordinarily would operate in your cross-hatched area, would it not?

A. Not necessarily: no. I have made no such statement as that.

Q. Where would it operate?

A. All over the thing, from top to bottom.

Q. Very well, wherever it operates, it would operate in that cross-hatched area or below?

A. Above or below.

Q. Is that so?

A. It will operate anywhere from a complete base load 100 percent of the time——

Q. I am assuming now that I am looking at this cross-hatched area which represents your Exhibit 74, I am looking at Exhibit 92 which represents your operations in December, and I am assuming a critical low-flow period just as you testified concerning Exhibit 74?

A. The cross-hatched area there represents the operation on the assumption that Buggs Island is operated as estimated in Exhibit 10.

Q. Yes; but at any rate there is going to be some time—and you testified that that would be the natural or the actual [3169] condition under which you would operate——

A. Under those assumptions.

Q. That that represents your Exhibit 74. In fact, your Exhibit 92 has a notation here, cross-hatched area, generation, Exhibit 74?

A. Yes.

Q. Now, when the water is not available, you have to have some steam to take the place of the hydro.

A. Steam capacity?

Q. A steam plant.

A. You don't have to have any additional steam plant.

Q. You have to have a steam plant to take care of that cross-hatched area, don't you?

A. No.

Q. Whether it is additional or not?

A. No.

Q. What would take place? Suppose you moved your hydro plant out of the cross-hatched area, what will take place of that operation?

A. It would simply be an interchange of position on the load curve of steam capacity and hydro capacity.

Q. Very well, whether it is an interchange or not, nevertheless when you move your hydro plant out of this position you have to have something to take its place; isn't that so?

A. It is already there.

[3170] Q. You mean you are going to operate something else in this cross-hatched area while hydro is operating there? Then you certainly would have a double investment.

A. When the operating hydro plant is operating there, the steam plant is operating every place else on the load curve. If you don't have that much water, the hydro plant moves up on the load curve, and the steam plant that was up above moves down below.

Q. Takes its place, so in order to make sure that you have power at all times in the area represented by your cross-hatching there, you have to have both a hydro plant and a steam plant; is it not so?

A. It requires——

Q. Let's answer my question.

A. You have to have some steam capacity on the system; is that what you want me to say?

Q. That is right, I want you to answer the truth. I am not looking for any specific kind of an answer. I want the record to be clear on this thing.

Now, my next question was, if you have to have both the hydro plant and a steam plant to take care of this area at all times, do you not have an investment of $40,000,000 to take care of that area instead of a steam plant which, as you have testified in connection with Exhibit 15, at an investment of $13,000,000 would have the power available here all the time?

[3171] A. If you are trying to talk about two alternate programs it is perfectly true that if we supply our power requirements with steam, and forget the hydro project, the investment will be substantially less, but if you put the hydro project in, you don't have to put the steam capacity in, you don't have to have both. There is no double investment.

Q. And what happens when you move the hydro capacity up to your black lines?

A. The steam capacity that was up there moves down.

* * * * *

[3174] Q. Mr. Cary, we were talking about the necessity of having a steam plant to take the place of the hydro plant when the operation of the hydro plant is moved out of the cross-hatched area on Exhibit 92. In view of the fact that you would have to have a plant available, in addition to the annual cost of your hydro program of $2,829,000 as shown on Exhibit 15, your annual charges will also include approximately $3,233,000 less [3175] the cost of the fuel that you would save when you operate the hydro plant in the cross-hatched area and less some adjustment in the charges for substation and transmission facilities.

A. Did you use a figure there of three million dollars?

Q. $3,233,000 less the cost of the fuel that you would save when you operated the hydro plant in the cross-hatched area and less the adjustment that would have been made in the charges for substation and transmission facilities.

A. No, that is not true at all, for this reason. The hydro project, with a capacity of 91,000 kilowatts, would take the place of the same amount of steam capacity and both investments will not be necessary. So the suggestion that you made yesterday that we would have a $40,000,000 investment to do a 91,000 kilowatt job is just not a fact. There is no substance in that suggestion at all.

Q. How can you say it is not a fact when you said that you would have to have a steam plant in order

to operate when the hydro plant is moved out of the cross-hatched area?

A. I made no such statement.

Q. Well, isn't that a fact?

A. No; it is not.

Q. What would you operate when the hydro plant is moved out of the cross-hatched area?

A. I would operate the same steam capacity that I was operating when the hydro plant was operating in the cross-[3176]hatched area.

Q. But you would now operate it in the cross-hatched area; isn't that right?

A. The assumed condition of operation.

Q. Is it right or isn't it?

A. I don't understand your question. It doesn't seem to make sense.

* * * * * *

[3178] CHIEF PRESIDING EXAMINER. But if the flow is very, very low, then you probably use your hydro at the peak and shift your steam down to the base load.

[3179] The WITNESS. That is correct. When the hydro is operating at base load, at the bottom, then your steam is up in the peak. Then if you have the extreme low flows which are indicated by the operation of Exhibit 61—that is the solid black on this Exhibit 92—and you put the hydro project in the peak of the load curve in order to make it generate the 91,000 kilowatts with those low flows, then your steam moves down and carries the base load and the other loads in between.

Now, there are any number, an infinite number, of variations between those two extremes. You don't necessarily go from one extreme to the other. Then the operation indicated by the cross-hatched area, on 92, which is the same as was shown on Exhibit 74, that is just an intermediate operation and it might be anywhere between the two extremes up and down the load.

CHIEF PRESIDING EXAMINER. I fear that perhaps you and Mr. Hankin were not quite understanding each other.

The WITNESS. I think that is the problem.

Mr. HANKIN. We understand each other all right, and therefore my question is this.

By Mr. HANKIN:

Q. Here you have a cross-hatched area which represents the operation of a hydro plant. Apparently that hydro plant is not like a steam plant. If it were a steam plant, it could operate in that area 100 percent of the time. Because it is [3180] this type of a hydro plant, the plant will have to be moved from this cross-hatched area and there will also have to be a steam plant available to take the place of the operation in that area. What I have asked Mr. Cary is to state something which is obvious. Wouldn't you then have to have a double investment to take care of that area and wouldn't you have to have an annual cost of both the hydro and the steam plants less whatever saving of fuel there is and whatever adjustments would have to be made on Exhibit 15 for duplication of substation and transmission facilities? It seems

to me it is a clear question which does not require any argument and I don't see any reason why the witness should try to avoid answering.

Mr. GATCHELL. The witness has answered, Mr. Examiner. It is a perfectly obvious proposition that needs no argument to show that there is no double investment proposed under the scheme that is set forth.

CHIEF PRESIDING EXAMINER. I think the witness has said there is no double investment.

Mr. GATCHELL. If Mr. Hankin has the wrong answer, that is his hard luck.

* * * * * *

[3181] By Mr. HANKIN:

Q. If you will look at Exhibit 15, Mr. Cary, suppose you did have both the hydro plant and the steam plant, the equivalent steam plant, shown on that exhibit. What investment charges could be eliminated?

A. On the assumption that you make, that I have both, no investment charges would be eliminated.

Q. In other words, you would have to have all of the items shown for substations, step-up and step-down transmission lines, and so forth.

* * * * * *

The WITNESS. I would like to amend that answer that I just gave. There might be some minor investment in the steam plant program. My recollection is that we included a synchronous condenser at Roanoke Rapids in the steam program which would not be necessary if you had both, but that is a minor part of it.

By Mr. HANKIN:

Q. Now, assuming again that you would have both plants, with the steam plant operating in the cross-hatched area when the hydro plant cannot operate in that area, how much of the fuel cost of $1,509,000 would be saved?

* * * * *

[3182] CHIEF PRESIDING EXAMINER. Can you answer the question, Mr. Cary?

The WITNESS. Not exactly. That would take substantial computation. But on the basis of the assumption which he has made, with which I have no disagreement whatever, there would be a substantial saving in the fuel bill as shown on that exhibit.

By Mr. HANKIN:

Q. Would it be as much as $1,000,000?

[3183] A. Possibly.

Q. It wouldn't be any more than $1,000,000?

A. I just don't know. It would take quite a computation to determine it. It would be substantial.

* * * * *

Q. Mr. Cary, I notice that in the cross-hatched area in Exhibit 92, the Roanoke Rapids project has a capacity of 91,000 kw. for 6 hours on Monday, 7 hours on Tuesday, 12 hours on Wednesday, 12 hours on Thursday, 8 hours on Friday, and 2 hours on Sunday, or a total of 47 hours in any week in December, is that correct?

A. I haven't checked those hours, but it sounded [3184] approximately correct.

Q. I also notice that in the black areas, in solid black areas in Exhibit 92, the Roanoke Rapids project has a capacity of 91,000 kw. for 1 hour on 1 day, Thursday, for each week in the month of December; is that right?

A. Did you say it has a capacity?

Q. Yes.

A. That is not correct.

Q. What would be correct? What is there about my question that is not correct?

A. You were stating that the project had a capacity of 91,000 kw.'s for one hour. That exhibit doesn't show that at all. It simply shows that 91,000 kilowatts was required for only one hour operating on the peak of the load curve.

Q. Very well. Will you look at the black areas and does the vertical line represent capacity?

A. No; it represents power generated.

Q. Well, how much power is generated?

A. The amount indicated there by the vertical length of the black sections in any hour you would want to look at it.

Q. And that is how much?

A. When?

Q. In the black sections.

A. Which hour?

Q. On Thursday.

[3185] A. Which hour?

Q. As shown on Exhibit 92.

A. Well, you mean nine o'clock in the morning?

Q. I am asking you where you show on Exhibit 92 in the black areas on top of the curve how much

capacity do you have there. What is the maximum capacity that you have there?

A. The maximum capacity is 91,000 kilowatts.

Q. All right, that is all I wanted to know. And for what period is that 91,000 kilowatts shown on Exhibit 92 represented by the black lines?

A. The black lines do not represent capacity. They represent power generated. 91,000 kilowatts of power is generated in only one hour.

Q. For one hour. Good. Now, please listen to this question. If you don't want to answer it, don't answer it, but don't try to evade it.

* * * * *

[3186] Q. Now, Mr. Cary, looking at Exhibit 92, you can always depend on having a power capability of 91,000 kw. for one hour per week in December, but you cannot always depend on having a power capability of more than one hour per week in the month of December; is that correct?

A. No; it is not.

Q. Will you explain why that is not correct.

[3187] A. That is not correct because it has been demonstrated here in this proceeding that even with the extreme minimum flow of record, which occurred during ice conditions in December of 1917, there was greater average flow in the river than is required to make the 91,000 kilowatts dependable on the load, on the system load of the company, in the December week of maximum load. Now, if that is true, even if you had a series of weeks exactly like the peak week—that, however is very improbable. These peak weeks rarely repeat and at the most I would think

I am safe in saying they never repeat more than once. So that this operation indicated by the black section at the top of Exhibit 92 represents the extreme condition in that regard, and we have shown that the river flow at that time, even with the assumed minimum release of 1,000 c. f. s., which was assumed in preparing Exhibit 61, we had more water than we needed. Now it appears that the minimum release actually that will be required will be 500 c. f. s. rather than 1,000 which means that you have substantially more water, even in the condition of extreme minimum flow, than is required to make this project dependable on the system load. My recollection is that you have roughly twice as much water as you actually need, and for that reason you could make 91,000 kilowatts dependable in a number of hours, not continuously, of course, but certainly more than was normally, even unreasonably, to be expected from the load curves that we have had in the [3188] past for many years and as we expect to have in the future for many years.

Q. Are you through?

A. I think that answers your question.

Q. Now, will you look at exhibit 92, and I ask you that question with reference to Exhibit 92.

A. All right. I was looking at 92.

Q. In fairness, Mr. Cary, I must say to you that you originally started out testifying on page 2287 of the transcript that this black area represents a hypothetical condition of extreme limitations and that your actual expected operation is Exhibit 74. Yesterday, in cross-examination, you seemed to have given very

much greater weight to your Exhibit 61. Now, I am going to ask you, in view of what you have represented on Exhibit 92, whatever the amount of water may show, your Exhibit 92 is a representation of the power capabilities, I ask you to state whether, in accordance with Exhibit 92, it is not true that you can always depend on having a power capability of 91,000 kw. for one hour per week in December, but you cannot always depend on having such a capability for more than one hour per week in the month of December. Isn't that correct?

A. That is definitely not correct. This Exhibit 92—I would rather say it this way. The black section of Exhibit 92 does not indicate in any way that the capability of [3189] 91,000 kilowatts is available for only one hour. It simply indicates that the estimate of load shown on that exhibit only required 91,000 kilowatts for one hour. Now, in some other year it might require it for two hours, maybe three hours. But the statement I have just made and other statements that are in the record I think show conclusively that if such a requirement of the load should exist, that there is ample water, even under those extreme minimum flow conditions during that ice period in December 1917 to make that full 91,000 kilowatts of capability from that project available as often as it is reasonable to expect the load conditions would require it.

Q. Now, Mr. Cary, you just testified with reference to the cross-hatched area that shows that the project would have a capacity of power capability of 91,000 kw. for 47 hours during the week. Now, when you

move the operation of the project out to those black lines, doesn't it show that the power capability, as you have just testified, is for one hour during the week—power capability of 91,000 kw.?

A. Are you through? No; I would like to go back and state that when I answered your first question I didn't catch the import of it and I will say there again that whereas the 91,000 kilowatts is the capability of the project, the cross-hatched area shows, just as I said the black area showed, the generation, the power generation, hour by hour, that would [3190] be obtained under the flow conditions assumed in preparing Exhibit 74.

Q. Then the power generation will be how much?

A. Well, it is never more than 91,000 kilowatts.

Q. That is right. For how many hours.

A. Depending upon the flow conditions.

Q. Well, we are now talking about this cross-hatched area.

A. Under the flow conditions assumed in Exhibit 74 for the cross-hatched area and under the load conditions shown for that particular week, the hydro project we estimate would be operated in that band on the load curve and that happened to work out to—you said 47 hours—I guess that is about right.

Q. And now when there isn't that much water available and you have to move up the operation of the project to your black lines—in other words, operate in accordance with the pattern of Exhibit 61—for how many hours will you obtain 91,000 kw. on Thursday?

A. If there were a moderate amount of water less than assumed there for Exhibit 74 and in the cross-hatched area, the project would move up to some extent, depending upon the amount of flow available. And under those conditions, the 91,000 kilowatts would be needed and also available for less hours than it would be as shown for the cross-hatched area. [3191] If the flow conditions were the extreme minimum of record, the project would move up very near the top of the load curve, but not quite that indicated by the black. If the flow conditions should be such as to just make possible the operations shown by the black area, then the number of hours at which we could make the project dependable on the load up to a maximum of 91,000 would be very small. It would not be as small as just one hour because, as I have said before, the other weeks before and after this week would be less and the requirements would be less and you could use your pondage to make the 91,000 kilowatts available for more hours than just the one. I can't answer just how many it would be.

Q. You have changed my question.

A. I am trying to make this thing perfectly clear for the record and as near the facts as I know how to make it.

Q. May I refer you to Exhibit 92 and note the heading of it "Estimated Weekly Loan Curve." Is that the correct description of this exhibit?

A. Yes.

Q. For December 1953?

A. Right.

Q. And does it state that this shows the relative location of energy and capacity on Exhibit 61 with energy and capacity on Exhibit 74?

A. That is correct.

[3192] Q. Now, let us assume that the time comes when you simply have to operate in accordance with Exhibit 61. You simply don't have any more water. My question was, how much of a capacity, or you call it power capability—for how much time will you have 91,000 kw. during the week?

* * * * *

The WITNESS. If the actual conditions in the week of peak load in December were approximately one-half of the minimum flow on record, then the flow conditions would require the operation somewhat as shown by Exhibit 61 and the full 91,000 kilowatts of capability on exactly that load pattern shown there would be limited to about one hour without using the storage in the Roanoke Rapids pond as I previously [3193] indicated it might be used.

By Mr. HANKIN:

Q. Now, under those circumstances, Mr. Cary, you can always have one hour of 91,000 kw. capacity, can't you.

A. At least that.

Q. No matter what the conditions of the river flow are, you can always have one hour.

A. At least one hour.

Q. But you cannot always have more than one hour.

A. That doesn't necessarily follow.

Q. Suppose that the flow of the river was as you stated and that you simply had no choice but to operate a hydro plant as shown exactly on Exhibit 61. Would you have more than one hour?

* * * * *

The WITNESS. I think you would because you would use your pondage to get more than one hour. If you did not use your pondage, you would be limited to one hour.

By Mr. HANKIN:

Q. You said that you might have more than one hour if you used the pondage.

A. Well, I meant to say I would have more than one hour if I used the pondage.

Q. Would you show me on Exhibit 92 where that is [3194] represented?

A. That isn't shown.

Q. I would like to refer you to the definition of dependable capacity in the Glossary of Important Power and Rate Terms, Abbreviations and Units of Measurement prepared under the supervision of the Federal Power Commission. Do you have a copy of it?

A. No; I do not.

Q. Perhaps it would save time if I read it. Dependable capacity is defined as "A load-carrying ability for the time interval and period specified when related to the characteristics of the load to be supplied." Then it continues to define what is meant by dependable capacity of a station and how it is determined. It says "Dependable capacity of a

station is determined by such factors as capability, operating power factor and portion of the load which the station is to supply."

Now, my question to you is this. Is it not true that the dependable capacity of the Roanoke Rapids project meets this definition in the sense that the project has a capacity of 91,000 kw. which is dependable on the load of the system for the interval of one hour per week for the period of the month of December?

A. No, I don't think that is correct.

Q. Wherein does your statement as to the dependable [3195] capacity of the project differ from this definition which I read to you?

A. That definition doesn't say anything about one hour.

Q. Doesn't that definition define your dependable capacity in terms of the time interval and the period specified? Which is your time interval and your period specified?

A. I haven't specified it.

Q. I know you haven't. But you said that your project would have a dependable capacity of 91,000 kw.

A. I think we demonstrated that——

Q. And you said that it would be dependable on the system load, and my question to you is for what interval of time and for what specific period will your project have such dependable capacity?

A. We have stated, I think repeatedly, that this project has more capacity, or rather it has the full

capacity for more hours than the system load requires. The Exhibit 61 in the top part of Exhibit 92, shown in black, simply indicates what the load requirements are and do not represent what the capacity of the project is. The capacity of the project is dependent on the amount of energy that is available from the project during the period of extreme river flow. We have demonstrated conclusively, several different witnesses have testified to the fact, that there is more water available than is required to make this project carry that top 91,000 [3196] kilowatts of the system load.

Q. For how long?

A. As long as the system load would require it.

Q. Yes; but for how long is that?

A. This particular exhibit indicates that it would only be required for one hour.

Q. So that if you define your dependable capacity of the project in terms of its dependability on the load of the system, you mean that it would have such dependable capacity for an interval of one hour each week in the month of December; is that correct?

A. No.

* * * * *

[3197] CHIEF PRESIDING EXAMINER. It is very difficult to tell sometimes for a mere lawyer whether a particular question has heretofore been exactly asked and exactly answered. I think I will let the question be answered. Do you recall what it is? Go on to the next.

By Mr. HANKIN:

Q. What is your test of dependable capacity which you apply to the project when you say that it has a capacity of 91,000 kw.?

A. The test of dependable capability——

Q. I asked for dependable capacity.

A. I make no distinction between those two terms.

Q. Very well, then we shall use those terms interchangeably.

A. The test of dependable capacity of a hydro system is the test to determine whether with the minimum flow conditions reasonably to be expected the project will carry a certain portion of the system load to which it is supplied and make unnecessary other sources of capacity to carry that top section of load, whatever it is.

Q. Now, you say with the amount of water reasonably to be expected.

A. Yes.

[3198] Q. The minimum flow reasonably to be expected. Now, with a minimum flow reasonably to be expected, you would not have, I take it, and correct me if I am wrong, a pattern like Exhibit 61, would you?

A. I wouldn't expect it because that pattern requires less flow than the minimum reasonably to be expected.

Q. And I believe that you testified on page 2287 and other pages of the transcript that the pattern that you would follow in the operation of the project in critical low periods would be Exhibit 74.

A. If the release of water from Buggs Island were as assumed in the Definite Project Report.

Q. But isn't that the critical flow that you assume on Exhibit 74? We do have Buggs Island.

A. Yes.

Q. Then why did you say that Exhibits 79, 80, 81, and 87 were incorrect because Exhibit 74 was applied as a test under those conditions?

A. Exhibit 74 has nothing whatever to do with the testing of dependable capability. It is a pattern of operation which we expect on the assumption that the release in December 1953 from Buggs Island will be approximately 7,000 c. f. s. If the release from Buggs Island is anything different from 7,000 c. f. s., the pattern of operation will be different from Exhibit 74.

* * * * *

[3200] Q. Now, Mr. Witness, suppose the river flow was still less than shown, than would enable you to operate your project according to Exhibit 61 for as much as one hour in December, but you could operate it only for fifteen minutes. What would you say would be the dependable capacity of the project?

A. I wouldn't know. There is no record that I know anything about that indicates the river flow has been anywhere near that. That would be an extremely unreasonable assumption of river flow.

Q. You mean there aren't any times when the river is so low, like for example 467 c. f. s. under the natural flow conditions that occur——

A. For extended periods of time.

* * * * *

[3207] Q. When on page 2987 you testified that Exhibits 79, 80, and 81, introduced by Mr. Hamilton, and Exhibit 87 introduced by Mr. Creim, contained no facts which would contradict your conclusion that Project 2009 would have a capacity of 91,000 kw. dependable on the applicant's system load, you meant, did you not, that nothing in those exhibits would contradict the statement that the project would have such dependable capacity for one hour each week in the month of December?

A. I meant what I said, not what you say.

Q. And that of course requires me to ask you whether that will be so applied to Exhibit 61, which is your exhibit of operation at the top of your system load. So far as that exhibit is concerned, that would be correct, would it not?

A. I have said repeatedly that Exhibit 61 does not show that the capability of this hydro project was limited to one hour. Exhibit 61 simply shows what is the required operation to make it dependable on the system load. That does not infer in any way that that is the limit of the capability of the project.

Q. Will you refer to Exhibit 61, please?

* * * * *

[3208] A. I have it.

Q. On that exhibit you have five days, do you not?

A. That is correct.

Q. Will you locate the days where you would have 91,000 kw. for the hydro project, on that exhibit?

* * * * *

[3209] The WITNESS. Operation of the project at 91,000 kilowatts is shown on that exhibit only on Thursday.

By Mr. HANKIN:

Q. Now will you tell us for how long a period of time you would have 91,000 kw. on Thursday on that exhibit?

* * * * *

The WITNESS. No; but I think I can answer it, but it will take a little explanation. It is not a question——

By Mr. HANKIN:

Q. All I am asking you is to look at that exhibit and state for how long you have represented their capacity or capability of 91,000 kw. for the hydro-plant?

A. I thought that was what you meant. This exhibit, I would like to repeat again, does not show capacity or capability. It shows operation. The operation of the project there at a load of 91,000 kw. is shown for only one hour.

Q. Mr. Cary, I invite your attention to the following statement on page 4 of Exhibit 29. Experience shows that the character of these loads may change to such an extent——

A. Where are you reading from?

Q. Page 4, Exhibit 29.

[3210] A. I have it.

Q. At about the middle of the page, experience shows that the character of these loads may change to such an extent that the most desirable method of operation of the reservoir may be considerably different from that assumed. Do you agree with this observation as applied to the VEPCO System load?

A. I think that is a true statement.

Q. Suppose you operate your proposed project on the peak of the system load in accordance with Exhibit 61, obtaining a power capability of 91,000 kw. for one hour on Thursdays in December 1953. Then in 1954, or 1955, or several years later, it develops that the system load requires 91,000 kw. capacity or capability at the top of the load curve for two hours on Thursdays in December. Then would the project be dependable on the system load?

A. Yes.

Q. Where on the system load curve represented by Exhibit 92 would you put the operations of the proposed project and at what capability?

* * * * *

[3211] The WITNESS. Exhibit 61?

CHIEF PRESIDING EXAMINER. Yes.

The WITNESS. No, sir; it does not.

* * * * *

By Mr. HANKIN:

Q. What is that 91,000 kw. of which you are talking with [3212] reference to Exhibit 61?

A. It is the operation required under the conditions assumed in that exhibit.

Q. Very well. With that expression, then, at first we used word capacity, you didn't like it. We used the word capability, and now you want to use the power required, very well. * * * We shall use that term. Now, when the power required is two hours instead of one, as shown on Exhibit 61, where on the system load curve represented by Exhibit 92 would you put the operations of the proposed project, and at what capacity or capability?

A. I can answer only part of that question. I would put it on there at a capacity of 91,000 kilowatts, but I can't tell you where I would put it on the load curve unless you give me the assumed flow conditions.

Q. Suppose the flow conditions are the same that obtain where you have to put your project at the top of a system load as represented by Exhibit 92, the years pass by, and instead of a requirement of one hour, you have a requirement of two hours.

A. I can answer that. I would put it near or at the top of the load curve.

Q. And where would you get the water that would enable [3213] you to obtain the capability for two hours rather than one?

A. I have stated on several occasions that the flow required to operate, as shown in Exhibit 61, is considerably less, and particularly if the minimum flow were 500 instead of 1,000, than the minimum recorded inflow under the worst conditions that have ever existed, so that shows that we have plenty of water to carry the 91,000 kilowatts for more than the one hour's operation indicated on Exhibit 61.

Q. Then Exhibit 61 would not apply, would it?

A. Not exactly, because your assumption went into the future. Now, in the future, with heavier loads on the system, 91,000 kilowatts relatively speaking would be further up in the peak of the load curve than indicated by 61, and the chances are that instead of the maximum capability being required for more time than indicated by 61, the chances are that it would be required for less time, even with the larger load in the future years.

Q. Well, if it is less time, how will you get 91,000?

* * * * *

The WITNESS. Well, I think I can make the answer clear to that. It seems to me that it is obvious that if the requirements were for less time, and the flow conditions in the river [3214] were more than were necessary for 61, as shown, it just obviously follows there would be no difficulty of getting the water to make the 91,000 kilowatts available.

By Mr. HANKIN:

Q. Then you are getting back to a 15-minute proposition, aren't you?

A. I just don't understand any connection there whatsoever.

Q. At any rate, less than an hour.

A. The requirement might be less than an hour, but that has nothing to do with the capability of the project.

Q. Well, now, you say it has nothing to do with the capability of the project. The capability would depend on the amount of water available, wouldn't it?

A. To some extent.

Q. Now, I am assuming the type of river flow for which you have to operate your project in accordance with your curve shown on Exhibit 61, but conditions have changed and the requirement is two hours rather than one. Where will you be?

* * * * *

[3217] Q. Now, suppose that your load curve does not fit this Exhibit 61, what will happen to these black areas that you have on top of Exhibit 92?

A. They would be somewhat different, but as we have shown time and again, there is much more water available than is required for that, and that just obviously follows from that that there is considerable flexibility in the change of the shape of that black section there at the top of 92, which is Exhibit 61.

Q. But obviously if there is more water available, you will have to project somewhere between the cross hatched area and the black area. Isn't that what you testified? You would be moving that project up and down that curve?

A. You move it—if more water is available than you need for carrying the top 91,000 kilowatts of load, you move it down far enough to efficiently use the water that is available, all the way down to the bottom of the curve, if necessary.

Q. And that is why I am asking you whether when you move your project down the curve, can you do so without displacing steam capacity?

* * * * *

[3220] The WITNESS. Whenever you move the operation of the hydroproject down on the load curve, some of the steam capacity that [3221] was

operating below the hydroproject on the load curve has to move up and operate above the hydroproject. I don't like the use of the word "displace" because I don't think it displaces it. It simply changes its location of operation on the load curve.

By Mr. HANKIN:

Q. Then doesn't it follow that when you adopt this type of, you might say, accordion method of operation up and down your load curve, you must always have steam capacity to take the place of your hydrocapacity when it leaves a given band?

A. That is not correct. The same steam capacity that was already operating simply moves to another location on the load curve, but no steam takes the place of the hydro. The hydro is still generating its full 91,000 kilowatts.

Q. But in any given band, it does take its place, isn't that so?

A. I don't think that is a fair or correct statement.

Q. Is it so, or isn't it?

CHIEF PRESIDING EXAMINER. It exchanges places with the hydro?

The WITNESS. It changes place on the load curve, and it is perfectly true that as the hydro moves down, it generates more energy, and the steam that moves up generates less energy, but the capacity, or the load carried by that capacity is the same.

I would like to change that. The maximum generation is the [3222] same. In some of the fringe hours it might be somewhat different as you change location.

By Mr. HANKIN:

Q. Mr. Cary, on what day did your peak occur in December 1949?

A. December 13.

Q. And that was what day of the week? Would it help if I remind you it was on Tuesday?

A. It might have been; I don't remember.

Q. By what amount did the peak between the hours of five and six exceed the peak that occurred between six and seven, which is the next highest hour?

A. I don't think I have that information with me. I don't have that information with me.

Q. Wasn't it approximately 52,000 kw.?

A. That sounds reasonable. I just don't remember.

Q. I might state that is a figure derived from Schedule 14, page 25, of Form 12, filed with the Federal Power Commission.

A. If it is from that report, it is apt to be correct.

Q. On what do you base your conclusion that in 1953 your peak will occur on Thursday in December rather than Tuesday?

A. Of course we can never tell exactly which day it is going to occur. It depends on weather conditions, but the reason that Exhibit 92 and the other load curves used in Exhibit 92 show that peak on Thursday is because those load curves were [3223] all determined from the December 1948 load curves which were the latest available at the time those exhibits were prepared.

Q. On what do you base your conclusion that the difference in December 1953, the difference between

the peak hour and the next to the peak hour, will be 91,000 kw.?

A. I will tell you how that load curve used in that exhibit was prepared. We took the exact load curve for the week of peak load in December 1948, and increased each hour of the entire week, all 168 hours. We increased them by the same percentage that the peak of 720 estimated for 1953 was over the actual peak for December 1948.

Q. And you say that your reserve capacity in 1953 will be in the neighborhood of 100,000 kw.?

A. That is correct.

Q. And you still think that in those circumstances the construction of the proposed project to obtain a capacity of 91,000 kw. for one hour in the month of December is a sound undertaking from an economic and engineering standpoint?

A. Will you read that question back, please?

(The question was read.)

The WITNESS. The project is not being undertaken to obtain a capacity, a top capacity of 91,000 kilowatts for just one hour per week.

By Mr. HANKIN:

Q. In the month of December?

[3224] A. In the month of December.

Q. That is not a method which you would use for obtaining a dependable capacity? Suppose we change that to your peak capacity. Do you think it is a sound engineering investment, engineering and economic investment, to obtain a peak capacity over one hour in December under extreme low flow conditions?

Do you still think that that is a sound undertaking?

* * * * *

The WITNESS. I can't give a simple answer to it. I can answer it, but I would like to state it my way.

CHIEF PRESIDING EXAMINER. Of course you are entitled to do that if that is the most direct answer you can make.

The WITNESS. I can say this, without any qualification, that I think the project will be a sound investment because it will [3225] make 91,000 kw. of capacity available on our system load, and will make unnecessary the installation of a corresponding amount of steam capacity, and for that reason it is a perfectly sound investment as has been shown on several occasions in this proceeding.

* * * * *

[3232-A] Q. Is it not possible to construct a new steam plant of 72,000 kw. and overload it by 25 per cent for one hour on Thursdays in the month of December?

A. I can't answer that. I don't know what that 72,000 is.

Q. Well, you want to know the purpose of my question. The 72,000 is a figure which, when increased by 25 per cent, will give you your 91,000.

A. If 72,000 kilowatts were the nameplate rating of a unit designed with a 25 per cent overload capacity as the term is usually used, we would not call capability of that machine [3233] 72,000 kilowatts.

Q. What would you call it?

A. We would call it what operating experience with that machine indicated was an efficient and reliable capability.

Q. It would have a rated capacity of 72,000?

A. We pay no attention to rated capacity. It means nothing to us.

Q. Some people do.

A. Yes; I think some do.

Q. And if that can be done, you can take a 72,000 kw. capacity plant and overload it to the extent of 25 percent, should not the value of the capacity of the proposed project be equated to that of a 72,000 steam plant which would mean that the value of the capacity of the proposed project would be reduced by some $425,000?

A. I can't follow your arithmetic, but I can follow your thought, and I can assure you that that has already been done in Exhibit 15. The steam plant evaluation shown in that project is not based on nameplate rating, but is based on actual capability, as I so testified when I presented that exhibit.

* * * * *

Testimony of Mr. Strandberg

Direct Examination

[2991] Q. Mr. Strandberg, have you heard the testimony of Mr. Hamilton regarding his Exhibits 79, 80, 81, and 82?

A. I have.

Q. Have you studied those exhibits?

A. I have.

Q. In your opinion, do any of those exhibits give any measure or test of the feasibility of the Roanoke Rapids project, as proposed by the applicant in these proceedings?

A. No; they do not.

Q. Why do you not consider that any of those exhibits give any measure of such feasibility?

A. All these exhibits attempt to fit a limited flow to a fixed load pattern for which a different flow is required. They do not take into consideration the estimated load curves of the Virginia Electric and Power Company and the fact that [2992] to carry the sharp peaks of these load curves, a much smaller amount of energy is required for an equivalent capacity. If such sharp peaks are not carried by the hydro plant, an equivalent amount of steam capacity must be made available to carry this load.

Q. What sort of a study do you consider necessary to determine the measure of feasibility of such project?

A. To determine whether this hydro plant can be dependable on the system load requires a comprehensive study of:

One: Stream flow records to determine probable future water supply; and,

Two: Estimated load curves of the Virginia Electric and Power Company to determine whether, with the varying stream flows to be expected, the plant capacity can be so fitted into the system load that it will reduce the amount of steam installation required by the amount of this hydro plant capacity.

Since the power supply system of Virginia Electric and Power Company is essentially a steam system, and the system load has grown to the point where it has a high sharp peak on the annual and maximum peak day load curves, a hydro plant such as Roanoke Rapids with rather large variations in stream flow can be fitted to the system load at positions on this load curve to suit the flow available in such manner as to make full capacity dependable on the load.

* * * * *

[2993] Q. Mr. Hamilton stated on the witness stand that there are considerable records of stream flow and that before anyone decided to go ahead with such a project, those records should all be studied to determine how the variations in flow would **[2994]** affect the dependability of the project.

Was such a study made, and what were the results of such a study?

A. All of the stream flow records available for the Roanoke River were studied, along with the estimated system load curves, to determine how dependable the Roanoke River would be on the system load.

Q. Mr. Strandberg, is there any change in your testimony which was given during the hearings in May and June 1949, regarding the feasibility of the Roanoke Rapids project as proposed in this application, which you consider should be made in the light of your study of Exhibits 79, 80, 81, 82, and 87, and the testimony of Mr. Hamilton and Mr. Creim with reference thereto?

A. No; there is not.

* * * * *

[3293] Cross-examination by Mr. HANKIN:

Q. Mr. Strandberg, on June 16, 1949, did you hear Mr. Cary testify when he explained the difference between Exhibits [3294] 74 and 61?

A. On June 16?

Q. Yes.

A. I probably did. I think I was here all the time.

Q. Do you recall that on page 2287 of the transcript he was asked whether Exhibit 74 was not identical in appearance with Exhibit 61, and his answer was that Exhibit 61 showed the hypothetical condition to illustrate the extreme effect of a sharp variation in load? He also stated the hypothetical condition was not intended to reflect the actual condition, but simply to show the project could operate with a very rapid change in output with the limitations set forth in Exhibit 8.

As to Exhibit 74, he stated as follows, and I quote: "Exhibit 74 for the month of December is intended not to show the hypothetical condition, but our best judgment of conditions which are expected to actually take place in December 1953."

Do you agree with Mr. Cary that Exhibit 74 represents the load curve of the actual operations of the applicant's project in the month of December whether during an average or a critical period?

A. Exhibit 74 shows, as I understand it, the operation with a particular flow, and if that flow is available, Exhibit 74 shows the pattern of load that will be carried by that flow.

Q. Will your please refer to Exhibit 74, and indicate where on that exhibit the particular flow is specified?

[3295] A. The flow specifically is not given.

Q. Now, could you turn—do you recall when he testified on page 2287 that he said that that would be the actual operation only if you had a particular flow, or did he say that would be the operation during an average or critical river flow year?

A. As I read his statement here, he doesn't talk about either average or critical year on page 2287.

Q. If you will look at Exhibit 74, doesn't that state that it presents the pattern for an average and critical river flow year?

A. The peak load, December 1953 average and critical year, river flow year, that is correct.

Q. It doesn't specify any particular flow?

A. No, sir. It does by inference. It states that it is tied in to Exhibit 10, and I believe that Exhibit 10 does give certain indications of how the government, how the Army Engineers figure the flow might be released.

Q. But whatever may be released during a critical or low flow year, according to what I have just quoted from Mr. Cary's testimony, this is how he intended to operate. That is the actual condition, isn't that so?

A. For 1953; yes.

Q. Now, assuming that Exhibit 74 represents the actual operations of the Roanoke River Project during the month of [3296] December 1953, why did you say as you did on page 2991 of the transcript that

these exhibits 79, 80, 81 and 87, do not give any measure or test of the feasibility of the Roanoke Rapids Project as proposed by the applicant in these proceedings?

A. It is very simple. The applicant proposes to operate this plant at various places on the load curve depending on the flow, as any hydro plant fitted into a combined steam and hydroplant system would be operated. With a particular flow, the plant would take certain position on the load curve. If you happened to be with lesser flow, and there is a point on the load curve where that flow will give you full capacity and the applicant requires full capacity, they would so operate, and the testimony in this case has a number of times pointed out, that Exhibit 74 is well down on the load curve, that there are many positions above that which require less energy, and if you had less flow you would operate at one of those other positions.

Q. Are you through with your answer?

A. Yes, sir.

Q. I didn't want to interrupt you. Doesn't your answer go counter to the assumption that Exhibit 74 represents the actual operation that will take place during the critical low flow period?

A. Mr. Hankin, when you are giving something that is supposed to be an average, you are giving one curve to show what [3297] you are going to do in a month, you show an average. That does't mean that at all times you are going to operate in exactly that manner, and I think that the testimony by Mr. Cary, while it may not so specifically state, is to show the

average operating condition during such a year, and if your flow varies during the month, as it is almost bound to do, your position on your load curve will vary, but your average may come out exactly at 74.

Q. But now, Mr. Strandberg, isn't that contrary to the assumption that Exhibit 74 represents the actual operations that will take place?

A. Well, I think it represents the actual average conditions, possibly the word average should have been put in there.

Q. We are now talking about a critical year. You see you strike an average between the critical——.

A. You are talking about average month?

Q. But what I asked you was this. I asked you to assume that Exhibit 74 represents the actual conditions of operation, and you gave me an answer which does not assume it. I appreciate your answer, but why not be frank about it?

* * * * *

By Mr. HANKIN:

[3298] Q. I am asking you to assume. Assumptions are estimates not to our liking, but I am asking you to assume that Exhibit 74 is as is stated in Cary's testimony, that it represents not the hypothetical condition, but our best estimate of conditions which are expected to actually take place, and so we assume those.

Now, assuming that to be a fact, can you say that Exhibit 79, 80, and 81 do not give any measure or test of the feasibility of the Roanoke Rapids Project as proposed by the applicant in this proceeding?

A. I certainly can and do. I assume that anybody who has had experience in operation of a hydro and steam system combined, when he has a load curve which has a sharp peak, and he is attempting to find out what the prime carrying capacity of any hydro system is on that load, that he fits it properly on the load curve regardless of some individual exhibit in the case.

Q. And that would be consistent with saying that Exhibit 74 represents the actual conditions which would obtain in the critical year of December 1953?

A. For average conditions, I would say yes.

Q. What do you mean by average conditions?

A. I have just stated a little while ago that as your flow varies you vary your hydro system on your load curve, and I believe any engineer who has attempted to consider the design [3299] and construction of a hydroelectric plant as part of a combined steam and hydro system, knows very well that as your flow goes down you put it up on the peak and as your flow goes up you put it down, and if you can carry capacity on the peak with the minimum flows so that you do not have to build that much steam plant, it takes the place of it, it gives you dependable capacity.

Q. Now, when you say average conditions, you mean allowing for certain deviations from the average?

A. Certainly.

Q. Now, how much of a deviation from the average would be permissible to enable you to obtain dependable capacity of 91,000 kw., with a flow, with a regulated flow of 4,310 c. f. s.?

A. How many deviations would be permissible depends entirely on the shape of the load.

* * * * * *

The WITNESS. If you had a load curve as put in this case which has a sharp peak, and it shows that you can get down to minimum flows less than the minimum natural flow and still carry that peak, you still are within variation, proper variation, and being able to carry dependable capacity.

[3300] By Mr. HANKIN:

Q. When you say you are referring to a load curve that has a sharp peak, which do you mean, do you mean Exhibit 74, or some other load curve?

A. Exhibit 74 is not a load curve of the system. I believe the number is 29.

Q. Will you look at the upper left-hand corner of Exhibit 74, and will you read those three words in there? What does it say?

A. The upper what?

Q. The upper left-hand corner.

A. Of Exhibit 74?

Q. Yes.

A. Estimated generation and discharge——

Q. No; there are three words above that.

A. I can't read the first word, but it is "Load Curve."

Q. Perhaps this copy will be clea er to you. [Handing document to witness.]

A. Daily load curve. I believe, Mr. Hankin, that that is part of the printed form on which this curve has been plotted.

Q. So you would say that Exhibit 74 does not purport, does not represent to be what it says?

A. I didn't say that.

[3301] Q. It is the daily load curve?

A. It is part of the daily load curve. The entire daily load curve I believe has been put in one of the other exhibits.

Q. And this is the daily load curve pertaining to the Roanoke Rapids project?

A. For the hypothetical case, yes.

Q. That is just it, Mr. Strandberg. Which is the hypothetical applicable case, Exhibit 74 or Exhibit 61?

A. Either one of them can be an actual load portion or it can be a hypothetical portion.

Q. Do you agree with what Mr. Cary said?

A. I agree with the intent of Mr. Cary's statement, yes.

Q. Now, Mr. Cary said that 61 represents a hypothetical curve under extreme conditions, that Exhibit 74 does not represent the hypothetical curve, but an actual operation. You are now saying at one time that Exhibit 74 is the hypothetical, and Exhibit 61 is the actual.

Now, what do you say as to these two exhibits, are both hypothetical or both actual?

A. Both of them are an attempt to fit certain specific flows to portions of the estimated 1953 load curve. One of them, Exhibit 61, I believe was presented to show that even under certain limitations as to rate of increase of flow you could carry 91,000 kw. on the estimated load curve for December 1953 even with those restrictions and with minimum flows

available, [3302] Exhibit 74 shows that on the estimated 1953 load curve with a certain assumption as to flow based on the Army Engineers report, a position on that load curve could be found which would use that estimated average flow, and fit onto the load curve.

Q. That is your explanation of Exhibits 61 and 74?

A. That is right.

Q. But that is not Mr. Cary's statement about them, is it?

A. Well, I am simply stating——

Q. Is it or is it not?

A. I don't know why you should ask me what his——

Q. I asked you whether you agreed with his statement, and you said yes; and now it appears that you don't.

CHIEF PRESIDING EXAMINER. Let's not argue with the witness.

Mr. MOORE. That is all this is.

CHIEF PRESIDING EXAMINER. Well, go ahead with your next question, please.

By Mr. HANKIN:

Q. In answer to the question, why you did not consider Exhibits 79, 80, 81, and 87 to give a measure of the feasibility of the project, you stated on pages 2991 to 92 and on page 2993 that these exhibits attempt to fit a limited flow to a fixed load pattern for which a different flow is required.

A. That is correct.

Q. My question is this. Doesn't Exhibit 74 present a fixed [3303] load pattern as the pattern to be

followed actually in the operation of the project during the month of December, as testified by Mr. Cary on page 2287 of the transcript?

A. I believe Exhibit 74 shows the position on the load curve estimated for 1953, which certain flows obtained from the report, of the Army Engineers indicate would assume to fit, to use up all of that water on that load curve.

Q. Now, my question was this, Mr. Strandberg. Doesn't Exhibit 74 present a fixed load pattern as the pattern to be followed, actually, in the operation of the project during the month of December as testified by Mr. Cary on page 2287 of the transcript?

A. Well, it may be that that is his statement. What page was that?

Q. 2287.

A. I believe it states it was their best estimate of the conditions that are expected to actually take place in December 1953.

Q. Now, then, isn't that exactly what these exhibits do show, namely that to obtain the capacity of 91,000 kw. with a load pattern in Exhibit 74, you must have a different flow which is not available during the critical flow period?

A. I believe these exhibits are intended to show that if you limit yourself to the hypothetical proposition that you will have to carry just a fixed load, and then if you don't have [3304] sufficient flow to carry that load, you can't meet it.

Q. That is right. Now, if you will eliminate the word "hypothetical" which you introduced, but not

Mr. Cary, then the answer to my question is yes, isn't it?

A. I will eliminate "hypothetical." It is an assumed estimate. It is an estimated position.

Q. It is the best estimate that an engineer can make; isn't that so?

A. Well, it depends on the engineer.

Q. Which justifies the expenditure of $27,000,000?

A. No, sir; it is not meant to be that.

* * * * *

[3312] Q. I take it, Mr. Strandberg, according to your testimony, whenever you cannot get the capacity with the load curve shown on Exhibit 74, you would have to move the operation of the project up on the load curve until you get to the pattern that is represented by Exhibit 61; is that correct?

A. In order to get capacity value; that is correct.

Q. Now, if you will turn to Exhibit 92, if you move the hydro project out of the cross-hatched area what will take the place of it?

A. Some of the steam plant which has been carrying the load above the cross-hatched area would be operated a few more hours in the day, and move down.

Q. Now, would you use the most efficient equipment or the least efficient equipment?

A. I would assume that a power company would put at the [3313] bottom of any load its most efficient units, and probably its least efficient units would be at the top of any steam plant operation.

Q. Now, will that steam equipment which you will be shifting around have to be available at all times in order to carry that load?

A. What do you mean "at all times"? Do you mean all twelve months in the year?

Q. Yes; whenever you have to move——

A. It is in the ratio of the load in the various months to the December peak; if your load drops off sufficiently, some plant would probably be cut out.

Q. In other words, you would have to have that much steam capacity available at all times so that whenever you move your hydro from Exhibit 74——

A. I didn't say that. I said that if the load were as much as shown on this curve, you would have to have so much steam capacity available, but in other months as your load drops off, it may drop off sufficiently so that you can cut out units or even whole plants.

Q. How about the critical month of December?

A. I would assume that during most of the critical month of December they probably would have available about the same capacity.

Q. By that you mean that your steam capacity would have [3314] to be available at all times, or is it the type of capacity that doesn't have to be available?

A. Well, I assume that they might not over week-ends keep the units all hot. I don't know exactly how they operate that system. It depends some on the time required to bring a unit into operation, but during December they would have to have available for

operation a certain capacity; whether it is all spinning reserve or hot, I don't know.

Q. Now, whether that capacity is a new plant or an old plant, it involves a certain amount of investment, doesn't it?

A. Certainly.

Q. Now, in order to take care of the cross-hatched area at all times, would it not be necessary to have not only the investment in the hydro plant, but also available the investment put into some steam plant?

A. For the same capacity?

Q. For the same cross-hatched area.

A. You would have to have the investment available for a capacity equivalent to the total load. If you had the hydro plant in operation, and it is capable of carrying 91,000 kw. of load, some place on the load from the top to the bottom, varying, you would need an investment for 91,000 kw. less steam plant than if you had it all steam.

* * * * *

[3315] Q. Now, let us suppose that you have an investment of say $27,000,000 in hydro.

A. Yes.

Q. And that operates in your cross-hatched area?

A. Part of the time.

Q. Part of the time, or most of the time; isn't that so?

A. Possibly.

Q. And then you move it out of that cross-hatched area. Then you would have to have investment in capacity available to put in its place?

A. To make an answer to that question, I would——

Q. It seems to me it calls for an answer, yes or no.

A. You don't have to have an investment for a duplicate amount of equipment.

Q. What do you mean by duplicate amount of equipment?

A. I mean exactly what I said in my last answer, that you need sufficient capacity available to carry the total load of the system. If you have 91,000 kw. of capacity of hydro available on the system, you need 91,000 kw. less steam plant than if it is all steam plant.

* * * * *

TESTIMONY OF MR. JESSEL

[2999] Direct examination by Mr. GATCHELL:

Q. Dr. Jessel, have you examined Exhibits 79, 80, 81, 82, and 87, introduced at this session and heard the testimony of Mr. Hamilton and Mr. Creim?

A. Yes, sir; I have.

Q. In your opinion, is it possible by use of a pattern of operations like that of Exhibit 74, to derive the dependable capacity of the Roanoke Rapids plant on the Virginia Electric and Power Company system load?

A. No.

Q. Why not?

A. The dependable capacity of a hydroelectric project is determined by taking into consideration the energy available from the plant during the most ad-

verse water supply period and placing it in the utility system load, in that portion of the load where it can be used to its maximum capacity as limited [3000] by the amount of water available and the characteristics of the peak portion of the load.

Q. Would you read a little more slowly, Dr. Jessel, please? I want Mr. Hankin and his staff to have an opportunity to follow you.

A. Yes, sir.

Q. Is there an exhibit in the record which could be used to determine the dependable capacity of the Roanoke Rapids project on the Virginia Electric and Power Company system load?

A. Yes, there is.

Q. Which one?

A. Exhibit 61.

Q. How much energy would be required to make the Roanoke Rapids project dependable in the amount of 96,000 kilowatts on the Virginia Electric and Power Company's system during the peak week of December 1953?

A. 909,000 kilowatt-hours. This energy, however, does not include the energy for minimum releases which are not on peak hours.

Q. What is the relation, if any, in your opinion, between Exhibits 61 and 74?

A. The two exhibits have no relation, in my opinion, except that Exhibit 61 represents the 96,000 kilowatt section from the system peak of Virginia Electric and Power Company for December 1953, and Exhibit 74 represents a 96,000 kilowatt [3001] block-load section at a lower position in the same load curve.

Q. Have you examined the monthly peak load characteristics of the Virginia Electric and Power Company system loads?

A. Yes, I have.

Q. Are you suggesting that the Roanoke Rapids plant would have capacity value to the Virginia Electric and Power Company system for only two or three hours out of the year or during only a single week out of the year?

A. No, sir; I am not. My exhibits and testimony in the record show that the project was found to be dependable based on a month by month study of the VEPCO loads and energy supply during the most adverse water flow period.

Q. During which month does the annual peak load occur on the Virginia Electric and Power Company system?

A. During December.

Q. Is the January peak load following the December peak load greater or less than the December peak load?

A. The January peak load is less than the preceding December peak load.

Q. Will you refer now to Exhibit No. 79.

A. I have it.

Q. Is the indicated use of storage for the Roanoke Rapids project as shown in column (b) properly distributed throughout the seven days to obtain the best utilization of Roanoke Rapids project output under the assumptions made on [3002] this exhibit and, if not, why not?

A. It is not used because, through a better distribution, it would have been possible to even out the data in column (s).

Q. Do the data shown in columns (j) through (o) indicate in any manner how the Roanoke Rapids project would be operated on the VEPCO system load, assuming the average daily flow of 4,310 c. f. s. given in column (c)?

A. No.

Q. How would you determine where on the Virginia Electric and Power Company system load the output of the Roanoke Rapids project would be used, assuming an average daily flow as shown in column (c)?

A. I would refer to the weekly load curve for the month in question and so place the plant on the load as to make possible the realization of the maximum output of 96,000 kilowatts from the project, including the existing plant, with the energy that would be available from such releases as shown in column (c) on Exhibit 79, namely, 4,310 c. f. s.

Q. Is this customary utility practice for the best utilization of hydroelectric plants in systems also having steam generating capacity, or is this an unusual or extraordinary practice?

A. It is customary and not unusual in determining the position on the load of any hydroelectric plant.

[3003] Q. Assuming for the purposes of this question that the assumptions made for Exhibit 79 as to flow in column (c) and the use of Exhibit 74 are not in dispute, then do the figures in column (r) on Exhibit 79 correctly reflect the maximum capacity

that would be available at the Roanoke Rapids project?

A. No, they do not. The usual test is that of utilizing the energy in the uppermost portion of the load of Exhibit 74 for each day in order to realize the greatest amount of capacity and thereby make the requirement from other sources a minimum of the same amount for each day.

Q. What is the effect on data in columns (r) and (s) of placing the Roanoke Rapids plant in the uppermost portion of the load curves shown on Exhibit 74?

A. Under the assumptions made as to the flow in column (c) and the use of Exhibit 74, as set forth in Exhibit 79, and with the use of Roanoke Rapids project output in the uppermost portion of the load curves of Exhibit 74, as I just described, the figures in column (s) would be lower than shown.

An inspection of Exhibit 74, which I have made, will show that more capacity is realized per kilowatt-hour of energy in the uppermost section of the load curve on the average than would be indicated from the over-all average for each day on that exhibit. This means that the figures in column (r) on Exhibit 79 are too low and that the project is not given its maximum capacity output under the assumptions [3004] which you have stated.

Q. If your analysis should be followed in the preparation of Exhibit 79, would any of the figures in column (s) be zero?

A. No, except possibly for Sunday. I haven't checked that through.

Q. Does this mean that the Roanoke Rapids project would not be dependable to the full amount of 91,000 kilowatts?

A. No; it does not.

Q. Why not?

A. It is not proper to use Exhibit 74 to determine the dependable capacity of the Roanoke Rapids project on the VEPCO load.

Q. Would the analysis which you have made of Exhibit 79 apply equally to Exhibit 87?

A. It does.

Q. Would there be any difference in the load proportion?

A. The use of pondage there would be considered more satisfactory, but there may be some variation required to get a uniform minimum requirement.

Mr. HANKIN. I am sorry. I did not understand that last statement.

The WITNESS. I said, in the lower part of Exhibit 87, the use of pondage is fairly satisfactory, but some variations may be required to get a uniform minimum requirement from other [3005] sources during the week.

By Mr. GATCHELL:

Q. Taking up Exhibit 80, is the indicated use of storage for the Roanoke Rapids project as shown in column (b) of Exhibit 80 properly distributed throughout the seven days to obtain the best utilization of Roanoke Rapids project output under the assumptions made on this exhibit and, if not, why not?

A. It is not. In my opinion, Exhibit 80 has not been prepared for the purpose of showing the best utilization of the Roanoke Rapids plant output under the assumptions made on that exhibit. There could have been a better distribution of the use of storage than that shown on the exhibit.

Q. Do the data shown in columns (j) through (o) on Exhibit 80 indicate in any manner how the Roanoke Rapids project would be operated on the VEPCO system load, assuming the average daily flow of 4,310 c. f. s. given in column (c)?

A. Those flows are not that way in column (c).

Q. The average daily flows in column (c) are the natural flows?

A. That's right.

Q. That is right.

A. No; not for those natural flows.

Q. How would you determine where on the VEPCO system load the output of the Roanoke Rapids project would be used **[3006]** assuming the average daily flows shown in column (c) on Exhibit 80?

A. I would utilize Exhibit 61.

Q. Assuming, for the purposes of my question, that the assumptions made for Exhibit 80 as to flow in column (c) and the use of Exhibit 74 are not in dispute, then do the figures in column (r) correctly reflect the maximum capacity that would be available at the Roanoke Rapids project?

A. No. The figures on Exhibit 80, column (r), do not reflect the maximum capacity for the project.

Q. What is the effect on data in columns (r) and (s) of Exhibit 80 of placing the Roanoke Rapids

plant in the uppermost portion of the load curves shown on Exhibit 74?

A. The effect would be to make the figures in column (r) larger, and those in column (s) smaller.

Q. If your analysis should be followed in the preparation of Exhibit 80, would any of the figures in column (s) be zero?

A. No, except possibly for a Sunday.

Q. Does this mean that the Roanoke Rapids project would not be dependable to the full amount of 91,000 kilowatts?

A. No, it does not. It would not be proper to utilize Exhibit 74 to determine the dependable capacity of the Roanoke Rapids project on the VEPCO load.

Q. Would you give the same answers with respect to [3007] Exhibit 81 as you have just given with respect to Exhibit 80?

A. I would.

Q. Would you summarize your analysis of Exhibit 79?

A. In preparing Exhibit 79, Mr. Hamilton has not shown the most advantageous disposition of storage. Futhermore, he has not properly used Exhibit 74 for determining the greatest amount of capacity that could be realized from available energy under the assumptions of that exhibit. In other words, he has not obtained in Exhibit 79 the greatest amount of capacity that could be obtained from available storage capacity, the average daily flow, and the use of Exhibit 74.

Q. Would the same comment apply to Exhibits 80, 81, and 87, in your opinion?

A. Yes; for the flows shown.

* * * * *

[3333] Cross-examination by Mr. HANKIN:

Q. Dr. Jessel, you were present, were you not, at a hearing on June 16, 1949, when Mr. Cary was asked why Exhibit 74 was not identical in appearance with Exhibit 61?

A. I was here every day of the hearing, so I assume I was here then.

Q. Do you agree with the testimony given by Mr. Cary on page 2287 of the transcript, that Exhibit 61 merely showed a hypothetical condition to illustrate how the proposed project would be operated in extreme conditions, but was not intended to represent the actual condition or pattern under which the project would be operated?

* * * * *

[3334] A. I do not agree that Exhibit 61 is a hypothetical condition, or that Exhibit 74 is an actual condition.

Q. You say you do not agree?

A. No; Exhibit 61 and Exhibit 74 are merely two sections of a load curve, of an overall load curve for December 1953. The position on that load curve where the Roanoke Rapids project might operate would depend upon the amount of water available to it, and based on what Mr. Crewn said, and if he does operate as he indicated, it is possible that he may release flows equivalent to the natural flows.

Then I think that Exhibit 61 would be rather real to Mr. Cary in the operation of Roanoke Rapids. However, it may also be that in the operation of the Buggs Island project to meet the loads which may be served from it, flows may be very nearly like those required to permit the operation in Exhibit 74, so I say at this time I don't believe anyone knows what operation a project might have because from my reading of the testimony, Mr. Creim himself doesn't know how he can operate the Buggs Island project.

[3335] Q. Well, I am glad that you gave us that explanation. It wasn't in my mind up to now. Now, I wish you would explain this point. Assuming that Mr. Cary's testimony on page 2287 was correct, how would you reconcile his testimony with the answer you gave to the question asked by Mr. Gatchell on page 3000 of the transcript, namely what is the relation, if any, in your opinion, of Exhibit 61 and Exhibit 74? You answered that the two exhibits have no relation except that Exhibit 61 represents a 96,000 kw. section from the system peak for December 1953, and Exhibit 74 represents a 96,000 kw. section at a lower position on the same curve. Now, my question is, assuming that Mr. Cary's testimony was correct, how would you reconcile that with the answer that you gave?

* * * * *

The WITNESS. I am trying to, but I don't think it is particularly clear to me as to what he means by reconcile.

By Mr. HANKIN:

Q. What I mean is this. After all, when Mr. Hamilton and Mr. Creim presented their exhibits, they proceeded on the assumption that Mr. Cary's testimony was correct, I mean the one given on page 2287. I can well see how you might have answered that no, I could not assume that premise, but if I do [3336] have to assume it, such-and-such would be my answer. But you said that the two exhibits have no relation, either. Now, assuming that Mr. Cary's testimony was correct, could you have given the same answer?

A. I don't know whether I could or not. I mean it requires more than just a reading. I would want to analyze what he said and what I said rather carefully before I gave an answer to that kind of a question.

Q. On page 3000 of the transcript, you also testified that there was an exhibit in the record which could be used to determine the dependable capacity of the Roanoke Rapids project on the Virginia Electric and Power Company's system load, namely Exhibit 61?

A. That is right, I did so state.

Q. That is the exhibit that determines the dependable capacity?

A. That is the test I would make in determining that, yes.

Q. My question is this. Would you determine the dependable capacity of the project by means of a load curve which represents a hypothetical extreme

condition, or by one which represents the actual operation of the project during a critical period?

A. I would determine, whether you call it, hypothetical or actual, to me it has no significance. I would determine it by placing the project energy in that part of the load curve [3337] where it would be dependable to its full amount. Now, I don't go along with some of the definitions given as to certain exhibits.

Q. On page 2999 of the transcript, you were asked whether it was possible by the use of a pattern of operations like that of Exhibit 74 to derive the dependable capacity of the Roanoke Rapids Plant on the VEPCO system load, and your answer was in the negative.

A. That is right.

Q. And the reason you gave was that, and I quote, "The dependable capacity of a hydroelectric project is determined by taking into consideration the energy available from the plant during the most adverse water supply period and placing it in the utility system load, in that portion of the load where it can be used to its maximum capacity as limited by the amount of water available and the characteristics of the peak portion of the load."

A. I did say that.

Q. Aren't you saying in effect that the pattern of operations like that of Exhibit 74 can't be used when there is not sufficient water available, but could be used if the water were available and the operation of the project would probably fit into the company's load curve?

A. No, I am not saying that at all. The test of the dependable capacity is always made first to see to what extent [3338] its full capacity is available from the energy which would be provided from the flow or releases. Once that test is made, then the next point is to see where on the load curve you would place that plant if you have more water than you need for determining dependable capacity.

Q. When Mr. Cary testified as he did on page 2287 that Exhibit 74 represented the actual load curve for the operation of the project during a critical week in December, didn't that imply that the water would be sufficient to enable the applicant to operate its project in accordance with Exhibit 74?

A. I can only read what the record shows, but I understand that that was based upon one set of assumptions, which was included in Exhibit 29, whereunder the Buggs Island and Roanoke Rapids project were tested to see whether the VEPCO load could use both projects, and the releases there used were seemingly patterned on Exhibit 10. Under that condition, if as much water were available as indicated in that particular Exhibit 29, then he would either have to operate there or some other place. He may split the plan, operate some above and some below. There is nothing sacred about that Exhibit 74 position.

Q. Well, didn't Exhibit 29 deal with the average flow rather than the critical flow?

A. It has both flows in it.

Q. Could you point to the flow in Exhibit 29 which would show the operation of the project in accordance with Exhibit 74 [3339] during the critical low period?

A. On the load curve for December 1953, week of annual peak, there is shown on that load curve, particularly for Thursday, the combined operation of Buggs Island and Roanoke Rapids to the extent of 173,000 kilowatts. You will note, if you will make the analysis, that Exhibit 74 falls within that block. The Thursday amount falls within about the upper half, not quite all the way to the top, but pretty close to it. That is included in Exhibit 29.

Q. Now, will you look at Exhibit 74, and state whether there is anything in there that indicates that the operation in connection with Exhibit 29—does that indicate that Exhibit 74 is a load pattern applicable to both average and critical flow years? Perhaps I didn't state the question.

Will you look at Exhibit 74 and see whether that is a load pattern that applies to both critical and average river flow years?

A. It states average and critical river flow year based on operation of Buggs Island Plant as set forth on Exhibit 10, as one of the conditions in the exhibit.

[3340] Q. Now, there you see how many hours of operation at 91,000 kw.?

A. I haven't counted them, but I can count them for you.

Q. On Thursday it is 12 hours; isn't it?

A. 12 hours are shown.

Q. Now, will you refer back to the curve to which you have just referred in Exhibit 29 for December; for how many hours of operation do you find the 91,000 kw. during that month of December?

A. You mean the same day or the same month?

Q. The same day.

A. 12 hours.

Q. You say 12 hours?

A. 12 hours.

Q. On Thursday?

A. On Thursday.

Q. Now, is there anything on that curve to indicate that that applies within the critical flow period?

A. It reads Buggs Island and Site B dependable capacity, which suggests that it would be during a critical period under the assumption of Exhibit 10.

Q. Well, now, Mr. Jessel, I asked you this question: Is there anything on that curve which would indicate that this is applicable to a week of critical low flow.

A. The term "dependable" indicates that; yes.

[3311] Q. The term "dependable"?

A. Yes.

Q. Then why do you say that in order to test the dependable capacity, you would use Exhibit 61, which shows only one hour of operation at 91,000 kw.?

A. Because that would be the first test. Under Exhibit 10, there is so much water available that the plant has to be moved down on the load until the water utilized the energy, otherwise you have spill. That is not the test of "dependable."

The first test is testing the peak, and after you find more energy available than you need, then you move the plant down.

Q. Now, then, if, as you say, this curve that you referred to in Exhibit 29 applies the month of critical flow —

A. I said only under the conditions specified on Exhibit 10.

Q. Is there anything on that curve to show the conditions specified on Exhibit 10?

A. That is only one sheet of a whole study.

Q. Yes; can you show me where it says that this curve shown for December 1953, that certain conditions included in Exhibit 10 are incorporated?

A. Not on that particular curve. I will check it again, and see what it says. That curve itself doesn't mention [3342] Exhibit 10.

Q. Now, you said that that curve shows that on Thursday you would have in operation 91,000 kw. for 12 hours. I don't quite see that.

Could you explain how you get the 12 hours?

A. I took Exhibit 74 and superimposed it on this load curve in Exhibit 29, and the red-hatched areas, as shown there, they are just duplicated——

Q. Just a second, please; I am looking at a different curve. There is another curve in here.

A. That is the load duration curve.

Q. You are referring to another curve?

A. The daily load curve, hour by hour variation.

Q. Is this the curve [indicating]?

A. That is the one. I colored that in, referring to Exhibit 74.

Q. Yes; in other words, what you did was to put in colors certain areas which are represented on Exhibit 92; is that right?

A. No; I did this long before 92 came to my attention.

Q. Now, then, let me see what that means. You found a band on this curve which I will describe more particularly as the indicated weekly load curve for December 1956; is that correct?

A. No; December 1953. You have the wrong curve, Mr. [3343] Hankin.

Q. Oh, I see. You have found a band where you can fit in your Exhibit 74?

A. That is right, except for the cross-hatched area which is not a part of the load curve, but will build up to a load curve.

Q. You are saying that that shows that Exhibit 74 is applicable during a week of critical low flow?

A. No; I say that for the combination of Buggs Island and Roanoke Rapids on the load combined, that is the band for which Exhibit 74 cuts through for Roanoke Rapids.

Q. But what I asked you was to state whether that shows that the pattern used in Exhibit 74 would be applicable for periods of critical low flow.

A. That in itself does not.

* * * * *

[3347] Now, the upper 61,000 kilowatt portion, the load factor for Monday is 0.588; for Tuesday, 0.670; Wednesday, 0.833; Thursday, 0.846; Friday, 0.723; Saturday, 0.491, as compared with the others.

That will give you an indication.

By Mr. HANKIN:

Q. Now, after stating on page 3004 that the figures in column (s) according to your method, would not be zero, you further state that this does not mean that

the Roanoke Project would not have a dependable capacity for the full amount of 91,000 kw. for the reason that Exhibit 74 is not the proper exhibit to determine the dependable capacity of the Roanoke Rapids project on the November load.

Does it not follow that, operating the project under the pattern as shown on Exhibit 74, you do not get the full capacity of 91,000 kw.?

A. Assuming that such an operation was required, I think it is fairly obvious.

Q. And in accordance with the testimony given by Mr. Cary on page 2287, it was assumed that such an operation was required.

* * * * *

The WITNESS. That was only based on the assumption of [3348] certain flows being available, and certain coordination between Buggs Island and Roanoke Rapids. Obviously you have to operate so as to not spill water.

* * * * *

[3352] Q. Oh, no doubt.

A. Then the whole exhibit in my understanding has no meaning at all, because you are working with conditions which are not practical.

Q. Then you misunderstood the exhibit, Mr. Jessel.

CHIEF PRESIDING EXAMINER. Gentlemen, this discussion between the counsel and the witness is fairly interesting, but I will ask counsel to proceed with his questions.

Mr. HANKIN. I think Dr. Jessel has clarified quite a number of points here.

CHIEF PRESIDING EXAMINER. Yes.

By Mr. HANKIN:

* * * * *

Q. Dr. Jessel, let us turn to your criticism of Exhibits 79, 80, 81, and 87. In criticizing Exhibit 79, you stated on page 3002 of the transcript that the storage in column (b) was not properly distributed, and that through a better distribution it would be possible to even out the results in column (s); is that correct?

A. I believe—the record says what I said, but I recall [3353] saying something like that.

Q. Do you mean that the storage and the average daily flow could have been distributed more evenly so that on the following Monday you would again have a full storage of 5,000 c. f. s.-days; whereas in Exhibit 79 the storage was drawn down to 30 c. f. s.-days on Friday night and therefore the deficiency shown in column (s) would be the same each day; is that correct?

A. No; I don't mean that at all.

Q. What did you mean?

A. I mean that the use, first, of the average daily flow figures in column (c) were assumed constant for the purpose of that exhibit. Assuming that is acceptable, without any dispute, then the use of storage in column (b) would depend on an analysis of how much water would be required, day by day, to follow out the pattern Mr. Hamilton used, so as to get the same minimum requirement for the capacity day by day.

In other words, the storage use is based upon the load to be met, and not the other way around, so I

say by applying the storage releases by a more orthodox method, it is easily obtainable.

In other words, you take the load you have to meet. The water goes with it, if you distribute it properly, to see what is available from natural flow and what has to come from storage.

My second point is this: This shows only one week in December. It doesn't say whether it is a peak week, or does it? **[3354]** It doesn't say in the exhibit.

Q. It is the first week in December.

A. If that is the peak week, then the use of storage will not be on the weekly basis as shown there. We know from Exhibit 29, the distribution between a peak week and the month of December is not the same actual pattern.

In other words, the monthly energy is less, percentage-wise, or load factor-wise, than it is for the peak week, so by a more refined use of storage you have to go beyond the week in question to make a thorough and supportable test.

Q. But you said that the water used was not evened out. What do you mean by "evening it out"?

A. I meant by evening it out, assuming that the data in column (k) would have a uniform requirement from other sources.

Q. To have a uniform requirement from other sources would also mean what? Following what kind of rules in column (s); the same results or different results?

A. For purposes of my answer, I assumed that we would follow Mr. Hamilton's pattern, and even in

that case he could have made better use of storage.

Q. How would you even out the storage? The only way, as I see it, in Exhibit 79 where the storage is not evened out, is that the storage was drawn down to 30 c. f. s.-days.

A. I mean as to use between days. In other words, [3355] column (s) shows, whatever you want to call the new heading, the requirement for 45,000, 46.5, 48.7, 48.7, 42.9. The average requirement for that period may have been something less than the maximum of that figure.

Now, that is done this way. Even taking Mr. Hamilton's figures, the total load you have to meet—that is a definite figure, whatever assumptions you make—see how much energy you have available from the storage you assume you are going to use, plus the natural flow. Then distribute the storage backwards so that the figures in the last column are the same quantity, kilowatt-wise.

Q. You were talking about storage. Will you please look at column (h) on the exhibit?

A. I see column (h).

Q. And what would happen if you evened out the storage? What kind of results would you obtain in column (h)? Do you mean that on Friday you would have an amount which would be more comparable to that of the other days?

A. No; that is the remainder in storage. What I mean is that I would redistribute the daily use of the storage shown in column (b). In other words, Monday and Tuesday I may use less storage, because

you do have some play there; you are still below 5,000 and then pick up a little more in the latter case so as to even out.

Q. In other words, all you would do would be to get an [3356] average in column (s) for each day rather than the figures that you have?

A. Not an average; it is not quite that easy. It would be the same quantity.

Q. The same quantity——

A. For each day.

Q. The deviation from the average would be practically zero?

A. That is right?

Q. Now, if you did that, Dr. Jessel, would the figures in column (s) be substantially different from what they are?

A. They could be if you had a different storage in column (b). I say that this represents only one week's use of 5,000 c. f. s. storage, but they could be different if you used a different storage.

Q. You can't have more than 5,000 c. f. s.-days in storage; can you?

A. You might, if you went over a week. In other words, a week alone doesn't give a full answer. That is my point.

Q. In other words, you would start the next week with less storage.

A. And would need less storage, too. I could. My point is that a week alone in December is not enough to make the over-all study.

[3357] Q. And at any point of time, whether you would need less storage or not, only the future could tell?

A. Well, the pattern of loads is pretty definite. I don't think it is quite that general.

Q. On page 3007 you stated that "In preparing Exhibit 79, Mr. Hamilton has not shown the most advantageous disposition of storage."

Did you mean that Mr. Hamilton should have used more than 5,000 c. f. s. as the usable storage?

A. He could have used more; yes.

Q. Do you recall your testimony as to the usable pondage of the Roanoke Rapids project in the original hearing?

A. Could you give me the reference? I don't recall that far back.

Q. May I refer you to page 616 of the transcript—perhaps it wouldn't be necessary for you to look at it, I have a copy of it.

A. I assume the copy is correct.

Q. Did you not, in answer to a question, testify as follows:

> The Roanoke Rapids project would be in effect a run-of-river development with only about 10,000 acre-feet of pondage. The flow of water to it would be controlled by the large reservoir of the upstream Buggs Island project. The released water to the Roanoke Rapids project would be [3358] determined by the operating procedure adopted for the Buggs Island project. In turn, the operating procedure for the Buggs Island project would

be determined by the monthly load characteristics of the loads to be served by this project.

meaning, I suppose, the Buggs Island project.

A. That is right.

Q. Now, on page 811 of the transcript you testify in answer to that that the project would have a pondage of 10,000 A. F., acre-feet; is that right?

A. I said about 10,000.

Q. And you heard also the testimony of Mr. Cary that in average or low-water periods, the usable pondage would average one foot?

A. I see no relation between the average use of pondage and the use of pondage for determining dependable capacities.

It may be, if I may finish it, a dry year may come only one year in ten or one year in 20, and I can't conceive of use of pondage more than required for the particular operation.

Q. Now, Dr. Jessel, that 10,000 acre-feet, to make sure it is clear in the record, amounts of 5,000 c. f. s.-days; doesn't it?

A. About that; yes.

Q. Let us assume that you could us a three-foot drawdown, which would give you a usable storage of 7,166 c. f. s. How [3359] much more dependable capacity could you obtain during the critical month of December in column (r) of Exhibit 79?

A. Exhibit 79 doesn't show dependable capacity.

Q. Very well; let's use the term how much more capacity would you obtain in column (r)?

A. I haven't made any computation on that line.

Q. Do you think the difference would be substantial?

A. Under all the assumptions made here, assuming no dispute?

Q. Yes.

A. I don't know, because you may need to use more than 5,000 to smooth out column (s), sometimes more than 5,000.

Q. Were your two criticisms, according to your judgment, if you distribute the storage more evenly, you will have, too, more even distribution and lesser deficiency of kw. capacity than is shown in Column (s) of Exhibit 79, and if you increase the storage from 5,000 to 7,166 c. f. s.-days, you will increase the capacities still further, and the figures shown in column (s) would be still less; is that correct?

A. Along that line; yes.

Mr. HANKIN. I should like to ask that this exhibit, "Dependable capacity of proposed project at Roanoke Rapids with a regulated flow of 4,310 c. f. s. and a minimum release of 2,500 c. f. s. for navigation in relation to the load pattern in Exhibit 74, power storage and reservoir," 5,000 c. f. s.-days, in the [3360] upper part, and 7,166 c. f. s.-days in the lower part of the exhibit, be marked as "Exhibit 79–A."

CHIEF PRESIDING EXAMINER. It will be marked 79–A for the purpose of identification.

(The document above referred to was marked "Exhibit 79–A" for identification.)

* * * * *

[3366] By Mr. HANKIN:

Q. Dr. Jessel, in this exhibit marked for identification as "Exhibit 79–A," the basic assumptions are the same as in Exhibit 79. I am now talking about the upper part of Exhibit 79–A, marked for identification.

CHIEF PRESIDING EXAMINER. If anyone desires to object at this stage, I will sustain the objection.

(Objection sustained.)

* * * * *

[3367] Mr. HANKIN. Very well. Then I think we can shorten this thing by my making an offer of proof, because after all, I had to assume that this witness would answer the truth and nothing but the truth.

Now, as he has done all along, but there may be differences as to theory and fact in this case, my offer of proof is this. If the witness were permitted to testify, he would recognize that in the upper part of Exhibit 79–A we have the same development of the power generated in accordance with the load pattern shown in Exhibit 74, that in column (h) of this exhibit the storage is evened out, and that by evening out the storage, the loss in capacity from 91,000 is 52,746 rather than the amount of 48,000——

CHIEF PRESIDING EXAMINER. Just a moment. I think we will not have the offer of proof in this case. An offer of proof is useful and proper where you have some proof to offer, and where it is rejected because of some defect contained in the evidence you are offering, because it isn't competent for

some reason. This is not being rejected for any such reason as that, because I have not even examined it. It is being rejected because the Secretary of the Interior has no further time to offer evidence. [3368] He is not to be permitted to offer further evidence, and we are now closing the case with cross-examination on the rebuttal testimony. Therefore I rule that the offer of proof itself is improper in connection with this so-called exhibit marked for identification.

* * * * * *

[3373] Q. On page 3005, you testified that Exhibit 80 had not been prepared for the purpose of showing the best utilization [3374] of the Roanoke Rapids plant output under the assumptions made on that exhibit. Was that said by way of a descriptive fact concerning Exhibit 80, or by way of criticism of this exhibit?

A. I don't get the distinction of "descriptive fact or criticism." I don't know what you mean by that.

Q. I mean when you said that Exhibit 80 was not making best utilization of the Roanoke Rapids plant, did you mean that as a matter of fact, or did you mean that by way of criticism of that exhibit?

A. If I understand your question, my remarks, I think, went to the preparation and the assumptions made for that Exhibit, both preparation and the assumptions made.

Q. In other words, it was not the intention of Exhibit 80 to show the best utilization of the Roanoke Rapids plant; is that correct?

A. I don't think it shows the best use under the assumptions made.

Q. Do you mean to say it was not intended, or that it didn't?

A. I can't speak for what the exhibit is. The exhibit speaks for itself, and the witness who introduced them is responsible for what is meant by it.

Q. If that is the case, what is your understanding of the significance of this exhibit 80, since you have criticized it?

* * * * *

[3375] The WITNESS. Well, there are many factors in the exhibit which I think could be changed to make the project of Roanoke Rapids, under all the assumptions included here, better. However, the exhibit and its purpose isn't any too clear for me, or to me.

I can say, though, that there are many things which I think could be improved to make it more acceptable.

By Mr. HANKIN:

Q. Yes; but before that, Dr. Jessel, will you please tell us what your understanding is of Exhibit 80, because in your direct testimony you criticized that exhibit; didn't you?

A. I don't think I used the word "criticism." Will you show it to me in here?

Q. I refer you to page 3005.

A. The first question relates only to column (b); is that the one you have in mind, or what else did you have in mind? I don't like to answer that question. I would like to have it more specific.

* * * * *

[3379] Q. Mr. Jessel, was it not the purpose of Exhibit 80 merely to show that if you were to attempt to apply the pattern in Exhibit 74, you could not so operate the project except for one day during the entire month, and that thereafter you would not have the capacity shown in Exhibit 74, and that you would not have any storage except what you accumulate on week ends?

A. The exhibit speaks for itself. The purpose of it, I am not prepared to comment upon.

The term "pattern" as used there is not particularly clear. It is not necessary, as I understand it, to have the full requirement to follow a pattern, and furthermore, Exhibit 74 does not show an operation. It shows a portion of a load to be met. It has no relation to power supply, as such.

I just can't answer your question. It has no meaning to me, for the reasons I stated.

Q. You heard Mr. Hamilton's testimony with respect to Exhibit 80.

A. I heard it, but I can't say that I understood what he meant.

Q. That is all I wanted to know. Will you please refer to the questions and answers on page 3005, beginning with line 14, and ending with line 23, and will you please explain what you meant by the answers to those questions?

* * * * *

[3380] A. There are two or three questions there. The first question related to flows in Column (c), and the figure 4310 is given, and I didn't see that

particular figure, and I wondered whether I had the right exhibit before me.

The second question relates to natural flows, and my point there was the data in Column (j) through (o) would not in any way indicate how the VEPCO plant would operate on the VEPCO load.

Q. In other words, that Exhibit 80 was not intended to show how this project would operate on the VEPCO load, with the natural flows that are shown in Exhibit 80, is that right?

A. No, I didn't say that.

Q. What did you mean by that?

A. I said the data in (j) through (o) relate to Exhibit 74, and if natural flows occurred, the operation wouldn't be in accordance with Exhibit 74; that is what I meant to say.

Q. That is right. On page 3006, you testified, correctly, that the figures in Column (r) of Exhibit 80 would not reflect the maximum capacity for the project.

My question is, did you understand that by Exhibit 80 it [3381] was intended to show the maximum capacity that would be available at the Roanoke Rapids project?

* * * * *

The WITNESS. I understood Exhibit 80 to indicate the capacity—it says peak, and I assume maximum amounts would be available under the flows assumed, assuming the use of Exhibit 74 and assuming use of 5,000 second-foot-days' storage, as shown in Column B.

By Mr. HANKIN:

Q. It was the intention to show the maximum capacity?

A. What the intention was, I do not know, but I assume that is probably what they were trying to show.

* * * * *

Q. Would the results be different if you had a storage of 7,166 c. f, s.?

A. Under what situation?

Q. The same situation as Exhibit 80.

A. I believe so, but I haven't made a computation.

[3382] Q. Do you think that the maximum deficiency from 91,000 would be different?

A. I think it would be different even with 5,000 c. f. s.

Q. But with 7,166—that is your best judgment?

A. That is my best guess. I wouldn't want to give a judgment without spending more time on it.

Q. At page 3007 you said the comments you made concerning Exhibit 80 would apply equally to Exhibit 81. What is your understanding of the difference between Exhibits 80 and 81 in the light of the testimony given by Mr. Hamilton?

A. He made a different use of storage, and assumed a pattern of operations which he called parallel to Exhibit 74, which I understand to be reduced in scale.

Q. That is in what exhibit?

A. In Exhibit 81.

Q. Whereas in Exhibit 80, that pattern in Exhibit 74 was not reduced?

A. I didn't go into it that far to know exactly how he followed that pattern. He did state by footnote about the reduction in pattern.

* * * * *

[3387] Q. In testing the dependable capacity of the Roanoke Rapids project with Buggs Island in operation, would you use a regulated flow during an average flow period, or during a critical low flow period?

A. I would use neither.

Q. Then you do not agree with the testimony given by Mr. Sunda on page 3009 of the transcript, in which he stated [3388] that he used an average flow of 4,310 c. f. s.?

A. That is regulated flow.

Q. I said with Buggs Island in operation. With Buggs Island in operation, there is regulated flow, is there not?

A. I assume it would be regulated somehow with Buggs Island in operation. Assuming the existence of the Buggs Island project, I would use the flows which would be available to the Roanoke Rapids project at the time of the VEPCO system peak.

Now, should that be equivalent to 4,310, the minimum regulated flow, I would use that. If it was something else, I would use that.

Q. But would you use—in general, you say you would use neither in testing the dependable capacity of the project, you would use neither the average flow nor the critical low flow?

A. Not at a specific figure, no.

* * * * *

[3391] Q. What did you have in mind when you said that some variations may be required to get a uniform minimum requirement from other sources during the week?

A. What I meant was if they worked through with more storage, then the figures in column (s) may be less, may be constant, and that amount, if the total load on Exhibit 74 is to be met, would have to come from some other sources.

Q. And what other sources did you have in mind?

A. None in particular.

Q. What other sources are there available for VEPCO?

A. They have steam.

Q. Do they have any other sources available?

A. They have purchased power.

Q. So it would be either from steam power or from the purchased power; is that correct?

A. It could be. I don't say this is the total load, though.

Q. * * * On page 3,000 of the transcript, you testified that there is an exhibit in the record which could be used to determine the dependable capacity of the Roanoke Rapids project on the Virginia Electric Power system load, and this was Exhibit 61.

A. I see that.

Q. Is it not true that this is based on an assumption [3392] contrary to the testimony of Mr. Cary that Exhibit 74 represented the actual operations of the project during the critical week in the month of December?

A. I don't read it that way. He said that would be the operation if Buggs Island and Roanoke Rapids were coordinated together for the VEPCO load. I didn't understand that to mean that would be the way he would operate under some other assumption of water supply.

Q. Will you please recall again what you said concerning his testimony on page 2287?

A. What is your question?

Q. My question is this: You testified on page 3000 of the transcript that there is an exhibit in the record which could be used to determine the dependable capacity of the Roanoke Rapids project on the Virginia Electric and Power Company system load, and that this was Exhibit 61.

A. That is right.

Q. Now, is it not true that it is based on an assumption which is contrary to the assumption of Mr. Cary that Exhibit 74 represented the actual operations of the project during the critical week in the month of December?

A. No; I see no conflict there.

Q. In other words, the actual operations would be Exhibit 74?

A. No; they need not be. It depends on water available.

[3393] Q. Is that what Mr. Cary testified on page 2287?

A. He was responsible for it, he testified. I say the operation depends on the water available for the project, and the amount and the time; that is what I am saying. What he says I am not responsible for.

Q. You would disown his testimony on that?

A. I am not in a position to disown it or to corroborate it. All I am saying is that the operation of any project depends on the water to it. All I said was that Exhibit 61 is the one to use to test the dependable capacity. I didn't say where it would be operated at.

* * * * *

[3395] Q. Would you look at Exhibit 74?

A. I have it.

Q. Do the vertical lines show capacity?

A. No; the vertical lines show—except for cross-hatched area—the amount of load hour by hour which will be demanded from the system by the customers for the black load interval cut out by that section as shown by Exhibit 74.

[3396] Q. Now, do the vertical lines indicate anything by way of capacity?

A. No; the kilowatt load of the customers being served.

Q. And is that kilowatt load capacity, or is it energy?

A. It is energy per hour; kilowatt hours per hour.

Q. Are you talking about the area?

A. I am talking about the vertical lines, which shows kilowatt hours per hour. It also shows energy required.

Q. Will you look at the words in the left-hand margin? It says "Generation, megawatts." Do you see that on Exhibit 74?

A. I see it.

Q. Does that say "megawatts per hour"?

A. That says "megawatts." I am telling you what I interpret that to mean.

Q. Oh; that is your interpretation of Exhibit 74.

A. Kilowatt hours per hour.

Q. Let me ask you what Exhibit 74 shows. I don't care about your interpretation of it.

A. It speaks for itself.

Q. Does it show megawatts, or megawatts per hour?

A. I didn't say megawatts per hour. I said kilowatt hours per hour.

Q. Is there such a term as kilowatt hours per hour?

A. There certainly is. It shows the average energy for [3397] that hour. It does not show any megawatts; it doesn't show the 15-minute integrated peak. It shows the average energy per hour.

* * * * * *

[3398] Q. Dr. Jessel, in the matter of this concept of yours of the kilowatt hours per hour, when you have a given number of kilowatts which are generated for a given number of hours, how do you arrive at the number of kilowatt hours?

A. You mean average kilowatts for the hour?

Q. My question is this——

A. All right; let me hear it.

Q. If you have a given number of kilowatts——

A. What kind of kilowatts are there?

Q. I don't care, any kind of kilowatts, whether they are blue ones or green ones.

A. Integrated, instantaneous, or what?

Q. I am talking about the number of kilowatts.

Suppose [3399] you have ten kilowatts, and you generate for ten hours. How many kilowatts do you have?

A. Ten times ten.

Q. In other words, you multiply the kilowatts by the hours; is that right?

A. That is right.

Q. Now when you say you have so many kilowatt-hours per hour, do you divide the number of kilowatt-hours by the number of hours, or what do you do?

A. All I am——

Q. When you say per hour?

A. That expression—all that means is kilowatt-hours per hour corresponds to your average kilowatts for that hour. That is what I mean.

In other words, the actual variation within the hour may be above and below the average line.

Q. Now, please answer my question. Do you multiply by the number of hours, or do you divide it, when you say per hour?

A. A kilowatt hour is for one hour, you divide by one hour——

Q. In other words, when you talk about kilowatt-hours per hour, you mean kilowatts?

A. I mean average for the hour.

Q. But you mean kilowatts?

[3400] A. For the hour. The average kilowatt figure for the hour.

Q. All right; I see. You still think that there is any meaning to the concept kilowatt hours per hour?

A. That is not unusual.

Q. You say you studied mathematics at college?

A. I am an engineer by profession. I studied some mathematics.

Q. On page 3001 you have testified that your exhibits and the testimony in the record show that the project was found to be dependably based on a month-by-month study of the VEPCO load and energy supplied during the most adverse water flow period. When you say that the project was found to be dependable, do you mean dependable for 91,000 kw.?

A. Yes.

Q. If so, for what length of time; during what period and on what part of the load curve would the project be dependable during the most adverse water period?

A. There are actually in this record two adverse water periods, I studied three, actually, but one is of rather short duration. For purposes of the month-by-month study, the period—based on natural flows, first—the period from May through March was found to be the most critical. During that period, the month-by-month study showed that the Roanoke Rapids project, the critical group for that particular period ran [3401] from June through December. I did run the whole year through for the calendar year '30, and I found January 91,000; February, 91,000; March 91,000; April 91,000—this is on the use of a load curve now—May 91,000; June 91,000; July 65,000; August 57,000; September 36,000; October 36,000; November 90,000; December 91,000.

Need for other capacity ran 67 in January, 26 in February, 12 in March, some excess in April or May,

five in June, 79 in July, 90 in August, 80 in September, 90 in October, 70 in November and 90 in December.

In other words, the need for other capacity was a constant maximum amount during the critical period, and the project was dependable on the annual load curve month by month in the full amount for which it was required.

Q. For what length of time?

A. This is for a 12-month period, for the most adverse flow period, based on adverse flows.

I also studied the same——

Q. Just a second. What you mean is this: You don't mean that it was dependable all 24 hours a day; do you?

A. No.

Q. For what length of time during the day—take, for example, December—do you find that project was dependable for the amount of 91,000 kilowatts in the most adverse flow of record?

[3402] Mr. GATCHELL. You had not completed your answer to his previous question; had you, Doctor?

The WITNESS. No; I had not.

Mr. GATCHELL. I think, Mr. Examiner, he should be permitted to answer the question.

By Mr. HANKIN:

Q. You were going to say something else?

A. No; I said I had made more than one study to test that.

CHIEF PRESIDING EXAMINER. Go ahead and complete your answer.

The WITNESS. Next I studied the year 1917–1918, when the minimum, when the critical flows were due to freezing, and that was made for the year 1955.

Mr. Sunda, I think, has it ready for you for the year '53 based on Exhibit 61.

There I found that the flows, except in December and January, were much greater for the remainder of the year during the low flow months, so by use of Exhibit 61, we ran through—Mr. Sunda actually did, and will tell you on cross if you ask him—through the period '17–18, and I also ran through another study which had the most adverse flow of record, which occurred in September, I believe 1932, and that only occurred for a short time, and the September peak was 100,000 kilowatts less than the annual peak, and even if the [3403] flow were zero would have had no effect at all on the dependable capacity of the project.

By Mr. HANKIN:

Q. Now, will you tell me: during that December 1917 month, for how long was the project dependable for 91,000 kw., for what period of time, over what interval of time was that dependable?

A. Four percent of the time.

Q. Four percent of the time?

* * * * *

[3408] Q. Mr. Jessel, does Exhibit 92 correctly portray how the Roanoke Rapids project will be operated on the load of the VEPCO system?

A. Exhibit 92 is merely a load curve for a December 1953 week, and includes in cross-hatched and solid areas sections of the load curve. It doesn't

show to my knowledge how they will operate the Roanoke Rapids project, as such.

Q. So that Exhibit 61 is not representative of how the Roanoke Rapids project would be operated on the load curve?

A. Without a particular set of conditions you can't tell. If you know the flows, or the amounts of flow and the time of flow, you may use that and tell how they are going to operate. Unless you know what you have to go with the load requirement, or the demand, you don't know exactly where they will put that project.

Q. Assuming that you had the amount of water that would enable the company to operate in accordance with the pattern in Exhibit 74, is that cross-hatched area on that exhibit representative of how the project will be operated?

A. It may or may not be that. I don't want to sound uncertain, but if the flows were not—I mean if they do not come down too irregularly, they could operate under that pattern without any difficulty, under the cross-hatched section. In [3409] other words, even if the flows for the week averaged out in the amount required for the cross-hatched section, if the distribution between days is also assumed to be adequate, then it could operate on that cross-hatched section.

Q. What you are saying is that if they can operate their project according, as represented on the cross-hatched section, then they can operate it in accordance with that cross-hatched section, is that right?

A. No, what I am saying is the cross-hatched section merely shows a block of load which is part of the over-all load. After the releases of the water supply are adequate in amount and in time distribution, assuming no ganging up for one or two days, then it could operate in that section without any difficulty.

Q. And then when they operate that project as represented on the cross-hatched area, they would have a capacity of 91,000 kw. for a period of 47 hours, is that correct?

A. I didn't count them, but that sounds like about the right magnitude.

Q. Now, when they do not have the amount of water available, and they have to put the operation of the project on the load in accordance with Exhibit 61, as represented by those black areas, then they will have a capacity of 91,000 kw. for one hour on one day in December for each week in the month of December?

[3410] A. No, that is the requirement under plan if they operate up there.

Q. Will you look at Thursday in December, and tell me how much capacity is represented by the longest line on that exhibit, that longest black line?

A. The longest black line—the scale is not very good—about 90,000 kilowatts. I don't have a scale with me.

Q. Approximately 91,000 kilowatts?

A. 91,000.

Q. And that is for one hour on Thursday?

A. That is what you need, for one hour on Thursday during that week.

Q. Now, you said something about the fact that in December 1917, your project was dependable in the amount of 91,000 kw. for 12 per cent of the time?

A. Approximately that.

Q. Is that the same thing as saying it has a load factor of 4 per cent?

A. Not quite, not quite, because it is the relation between energy and the peak. At the moment I don't recall—this is based on 1953, my figures were based on 1955. I don't exactly recall whether I had the same shape or the same spread of hours. I can't say whether it is the same arrangement as 61 shows.

Q. Now, looking at the cross-hatched area, and the black [3411] area, is it not true that you can always depend on having a capacity of 91,000 kw. for one hour per week in December, but you can't always depend on having a capacity of more than one hour per week in the month of December?

A. I don't think it follows from that.

Q. You mean you can always depend on having 91,000 kw. during any week in December?

A. The number of hours for which you can depend upon the full 91,000 kilowatts is dependent upon the amount of energy available during this time. There is no energy figure on here.

Q. Doesn't that depend on the load curve?

A. No. The amount of time that 91,000 kilowatts will be available, the full amount, depends upon the amount of energy available during that same time.

Q. Not to complicate us, then, will you please answer this question with reference to Exhibit 92? Will you please look at Exhibit 92?

A. I am looking at it.

Q. And isn't it true you can always depend on having 91,000 kw. available for one hour on Thursdays in December?

A. No; this only shows what you need to have in December.

Q. But I am asking you this one question, and you are giving me an answer to another one. You said that in December 1917, which is the most critical of the months you had 91,000 for as much as one hour. Now, isn't it true that you can also [3412] depend on having a capacity of 91,000 for one hour on Thursdays in December according to that exhibit?

A. This exhibit has no relation to that. This exhibit is just the requirement for capacity.

Q. But you can always depend upon it, can't you?

A. If I have the water, yes.

Q. You say you can't depend on that project having a capacity of 91,000 for even one hour?

A. Yes, you can, you can depend on more than that, too. It depends on how much water you have.

Q. That is the second part of my question. The second part is, you can also depend on having a capacity for as much as one hour for any week during the month of December?

Mr. GATCHELL. Is that shown by Exhibit 92?

The WITNESS. Exhibit 92 only shows the requirement for one hour. It doesn't show supply. It shows

no information on supply at all, as I understand it, it is requirement.

By Mr. HANKIN:

Q. Can you get more than 91,000 out of that project?

Mr. GATCHELL. Do you mean according to Exhibit 92?

Mr. HANKIN. Yes.

The WITNESS. I don't understand that question, can they get more than 91,000. Under what assumption are you talking about?

CHIEF PRESIDING EXAMINER. Does Exhibit 92 show capacity?

[3413] The WITNESS. No, it only shows load to be met.

By Mr. HANKIN:

Q. You mean it doesn't show capacity?

A. Not as I understand it.

Q. Would you look at Exhibit 92?

A. I am looking at it.

Q. Do you see the words Relative Location of Energy and Capacity on Exhibit 61 With Energy and Capacity on Exhibit 74?

A. I see that.

Q. And yet you say it does not show capacity?

A. No, it just shows the load requirement.

Q. Where is the location of energy and capacity, which is the energy and which is the capacity?

A. Without referring to whether it is load or supply——

Q. Please answer my question, Dr. Jessel. It will take less time, which is the energy and which is the capacity?

Mr. GATCHELL. Will you let him answer your question? He is trying to.

The WITNESS. The curve itself shows hour-by-hour the total kilowatt requirement for loads. It is the need of the load hour-for-hour for the week in question. Now, if you take a load curve and superimpose upon it additional schedule of power production, then you have two stories on load curve, you have first the need, and then you have also superimposed on it, which is common in engineering, a picture of how you might meet [3414] that portion of the overall load requirement, but basically Exhibit 92, as I see it, is nothing but a load requirement, customer demand on the system.

By Mr. HANKIN:

Q. Dr. Jessel, isn't the energy here represented by the area of the curve and the capacity by the vertical lines?

A. The kilowatt requirement on the total system is represented by the vertical lines, by adding all the vertical lines to give you energy for the particular week.

Q. Dr. Jessel, the Examiner has stated he can't compel the witnesses to answer questions, and I can't compel you to answer the question.

CHIEF PRESIDING EXAMINER. I did not state that, as a matter of fact. I stated that I could not compel a witness to answer a question in any particular way.

As a matter of fact, we do have the authority in administrative tribunals to compel a witness to answer if he refuses to do so.

Mr. HANKIN. I understand that, Mr. Examiner. The only thing that I asked the witness to answer is this. Here is an exhibit which describes its relative location of energy and capacity on Exhibit 61 with energy and capacity on Exhibit 74. All I am asking this witness is to point out which is the energy and which is the capacity of Exhibit 61, and which is the energy and which the capacity relating to Exhibit 74.

The WITNESS. You didn't say that before, Mr. Hankin, as I [3415] recall it.

By Mr. HANKIN:

Q. Well, I am saying it now, Dr. Jessel. Will you please show that?

A. The capacity figures, however they are, are indicated by the vertical lines, and the energy figures are indicated by the summation of the magnitudes of the vertical lines.

Q. Now, if you trace this bottom line from zero, on the left-hand side, to the right-hand side, doesn't that represent the time, beginning with a zero hour on Sunday, and ending with a zero hour at midnight on Saturday?

A. You can add that up.

Q. That represents time?

A. Yes.

Q. Now, Dr. Jessel, will you please look at the black area on Thursday of Exhibit 92? Will you

please tell me for what duration of time that 91,000 kw. extends?

A. It extends for only one hour.

* * * * * *

[3418] Q. Is it not true that the dependable capacity of the Roanoke Rapids project meets this definition in the sense that the project has a dependable capacity of 91,000 kw., which is dependable on the load of the VEPCO system for the interval of one hour per week for the period of the month of December?

A. No. This definition is rather flexible.

Q. What do you mean by "flexible"?

A. The time interval—it doesn't say it is one week, one month, one year, three years or five years. The period specified isn't given, and the portion of the load to be supplied isn't given. It is a definition which is adapted to many possible uses, and there is no indication in this definition as to what period of time is to be used in the determination of dependable capacity.

Q. Now, first of all, Dr. Jessel, when you say the definition is flexible——

A. As to component parts.

Q. What do you mean by "flexible"? Do you mean the same thing as an elastic yardstick?

A. No; I mean the factors in the definition are not restricted as to time interval or the characteristics to be used.

Q. Of course not.

A. I say that to tie that down to December, alone, is not appropriate under the definition here.

[3419] Q. Don't you test your dependable capacity by the peak load?

A. Not entirely.

Q. What do you mean by not entirely? What part of it do you, and what part don't you?

A. Here is how you determine dependable capacity, practically. You take the system on which the hydro plant is to be utilized. You take the load to be met. Then you place this plant on the load month by month during the dry period. It may be a year, it may be five years, it may be three months. You determine what you can do with that project. Then you discard that hydro plant, and do it the same way, the same operation, with an alternative steam plant, and then the amount of capacity you need from the steam plant gives you the amount of dependable capacity you get from that hydro plant. That is how you do it practically.

Q. Tell me if that is the case. Suppose you did have a steam plant having a capacity of 91,000 kw. For what interval of time will that—what interval of time during a year will that plant be dependable?

A. Whenever needed.

Q. And what part of the time would that be?

A. That depends——

Q. Suppose you need it 100 percent of the time. Would it be dependable for 100 percent of the time?

[3420] A. If you needed that much; yes.

Q. Now, let us suppose that you have this hydro plant, and you need that capacity for 100 percent of the time. Would you have it?

A. Based on your assumption you need it 100 percent of the time, of course you wouldn't have it in any hydroplant that I know of.

Q. We are not going by any particular hydroplant.

A. I think in general.

Q. Therefore, it is necessary to determine for what interval of time you will have that capacity of 91,000 kw. whenever you need it; isn't that so?

A. The need; the dependable capacity is based on the load characteristics of the system in question, and the need to determine by the nature of the month-by-month characteristics.

Q. No doubt; I agree with you.

You don't mean dependable capacity would be determined by the amount of capacity you could get at times you don't need it?

A. That is my point: The ability to generate, water available and when you need the capacity, those three things determine it.

Q. And when you need the capacity is when you need it most, namely, during the peaking hours?

A. That doesn't give the whole answer.

[3421] Q. I am not asking for the whole answer. I am just asking this one question.

A. That is only part of the consideration.

Q. And when you need it most is during the peaking hours?

A. I won't say most. For example, Exhibit 36, which I introduced, explains that as well as anything else; it gives a month by month need, and on that exhibit it shows you need 94,000 in June.

Q. How does that answer my question.

A. That isn't the peak month.

Q. But during the peak month you certainly will need it; won't you?

A. You will need it according to what your load pattern requires.

Q. During that peak month you have a dependable capacity here for a given interval, and for during a given period.

A. What is the interval?

Q. The interval, as I understood you to say, was one hour, and the period is Thursday in the month of December.

A. You mean it is needed on this exhibit?

Q. Yes.

A. I get your point. I see what you are referring to.

Q. So that is so; is it?

[3422] A. That is right.

* * * * *

[3423] Q. Suppose you operate a project on the peak of the system load in accordance with the Exhibit 61, obtaining a capacity of 91,000 kw. for one hour on Thursdays in December 1953, and then in 1954 or '55, or several years later, it develops that the requirement of the system load peak in December is two hours instead of one hour.

Would the project then be dependable on the system load?

A. It could be; it probably is. Mr. Sunda, I think, will work that out.

Q. You say it could be?

A. I didn't work that out on Exhibit 61. I worked that out from my own study in 1955.

Q. But you don't know whether it is or not?

A. I myself haven't worked Exhibit 61.

Q. Then the answer is you don't know.

When water is not available for operation on the load curve of Exhibit 74, and the operation of the project is moved up to the position shown by Exhibit 61, what takes the place of the operation in the cross-hatched area in Exhibit 92?

A. I would normally expect the steam capacity would assume the cross-sectional area, and steam capacity would be replaced by the blackened area.

Q. Would you use the most efficient steamplant in the cross-hatched area, or would you use older equipment and operate [3424] the most efficient equipment on the base load?

A. I think in general, barring any system, local problems where you have to have certain machines on for load protection, of course you use the most efficient unit for the greatest number of hours.

Q. Now, when that takes place, when the hydro plant is moved out of the cross-hatched area, or considering the fact that it may have to be moved out of the cross-hatched area, will that steam equipment that you would use instead of hydro be available to carry that load at all times?

A. Oh; yes, the same time as would be required for the hydro. It is a transposition of positions.

* * * * *

[3425] Q. Dr. Jessel, I am not sure I understood your view given in the early part of your testimony this

morning in regard to Mr. Cary's statement to which your attention was called, which appears on page 2287 of the transcript, to the effect, as you will find it, that Exhibit 74 shows the company's best estimate of conditions that are expected to actually take place in December 1953. Do you recall that question?

A. Yes.

Q. Will you just explain your view on that more fully?

A. Well, my view is this: As I understand, Exhibit 74 is a section of the VEPCO load curve, a section of load which could be served by the Roanoke Rapids project if sufficient water were available as distributed by Exhibit 10 of the [3426] War Department's report, and that it represents the operation which would be required on the Roanoke Rapids project so as to utilize the energy available from the water.

Now, if any other amount of water is available, then of course it would be operated in a different position on the load curve. The location, which is Exhibit 74, would depend upon the other needs or factors, or having sufficient water available to operate in that position.

Now, my other point was Exhibit 61 represents the peak portion of the load curve, and it is normally the first portion you test for a dependable capacity figure. It is not measure of where you operate, but if you are so tied down by water limitations, you would operate very close to that, but if you have more water, of course you move down to the load curve to such a

point where your power supply available matches out with your power supply requirement.

Q. In the light of that statement, did you intend to state that you disagreed with the statement in two sentences there on page 2287, and quoting lines 8 to 15:

> The hypothetical condition there was not intended to represent the actual condition, but simply show that the project could operate with a very rapid change in output without that limitation applied to it.
>
> Exhibit 74 for the month of December is intended not to show the hypothetical condition, but our best [3427] estimate of conditions that are expected to actually take place in December 1953.

Now, in the light of the explanation that you have just made, when I first inquired of you, do you intend to disagree with either one of those two statements?

A. Well, the term "hypothetical condition" to me is not particularly clear. The words "it is a possibility," although not a probable expectancy——

Q. If was in that sense that you did not altogether——

A. Let me explain. Suppose that during December of a dry year Mr. Creim, as he has testified, chose because of other commitments, to let down the gross equivalent to the natural flow, say, in December, 1917. Then it is very likely that the system project, if it were built by VEPCO, would be forced into a situation where it would have to operate that plant very close, according to Exhibit 61, in order to get the capacity.

I don't say that is an expectancy. It is a possibility if Mr. Creim operates Buggs Island for his means in a certain way.

Q. Do you disagree with Mr. Cary's statement in this connection on page 2288, the next page, that the actual operation in any year would be adjusted to the flow conditions and the change in flow conditions actually encountered?

A. That is what I have been saying all along. Where you operate depends upon how the water comes, and in what amounts.

[3428] Q. You agree with that?

A. Yes; that is a natural expectancy for any hydroplant.

Q. I call your attention now to four excerpts from Mr. Cary's testimony in that same connection. The first is on page 2962 of the transcript.

Look at line 6 on 2962. Will you just read from line 6 through line 10:

> The only estimate then, and the only estimate now, of the operation of Buggs Island and its seasonal variation in releases is contained in the Definite Project Report on Buggs Island, Exhibit 10. These estimates of operation were used in preparing Exhibits 72 to 76, inclusive.

Then dropping down to line 15, reading through line 19:

> That is the release necessary to give the Army Engineers' figure for December power output in a year of critically low flow, as given in the Definite Project Report, in Exhibit 10.

I assumed the same flow throughout the month, without any increase in the week of peak load.

I next call your attention to the next page, 2963, the 18th line: "I used the figure for December power output from Buggs Island in the critical year as given by the Army Engineers in Exhibit 10."

I next call your attention to the next page, 2964, line [3429] 2: "As I have explained, I used the December release taken from the Definite Project Report."

Next is page 2971, beginning with line 4; you will see the answer there from line 11 through 22, and I will just read the answer:

> Exhibit 74 was based on average generation at Buggs Island of 34,500 kilowatts in December of the 332-day critical dry period. That figure was obtained from Table VI-3 on page VI-10 of Exhibit 10, the Army's Definite Project Report. That output represents a release of about 7,000 c. f. s. at the draw-down at Buggs Island, which that report showed would occur in December.
>
> For average water conditions, the flow and power regulation assumed in the Definite Project Report works out to a release at Buggs Island of 7,030 c. f. s. in December, or approximately the same as in the critical flow year. This figure comes from Exhibit 29, Table 4.
>
> We therefore showed in Exhibit 74 the operation in the critical year to be the same as in the average year.

Now, in the light of those four quotations, do you disagree with any of Mr. Cary's statement to which I referred in connection with 74, showing that Exhibit

74 assumed the flow to be the release from Buggs Island for December taken from the Army Engineers' expected schedule of operations as given in Exhibit 10?

[3430] A. I understood that is what he did. I haven't checked through the details on that part of it. Mr. Sunda may have; I don't know.

Q. Do you disagree with any of those statements?

A. The only thing I want to say in that regard is——

* * * * *

The WITNESS. At the time of Mr. Cary's preparation for testimony the only information available was Exhibit 10, the War Department Report. I did, however, make my own study, where I took the probable public load to be served, and redistributed the flow and reservoir operation for Buggs Island to a different pattern, so I had for my purpose no occasion to make the detailed check of Exhibit 10 on which Mr. Cary based his testimony, but from my over-all inspection of Exhibit 10, I find no fault with what he did.

Q. Do you not know that Exhibit 74 was based on the [3431] assumption, among other things, that the release from Buggs Island for December would be in accordance with the Army Engineers' expected schedule of operations as given in that Exhibit 10?

A. It follows from that and Exhibit 29, using 10 and 29, then working back to 74 and 61. It is a natural consequence of the available information.

Q. Now, in your month-by-month study that you made reference to in answer to a question by Mr.

Hankin a few moments ago, you made reference to requirement of capacity with respect to the Roanoke Rapids plant.

What did you mean by this 4 percent figure? We are not sure. Did you mean that the 91,000 kw. at Roanoke Rapids was required by the load for only four percent of the time, or that such a capacity is available only four percent of the time?

A. Required 4 percent of the time by the load shapes I used for '55, which were probably different from those in Exhibit 29.

Q. Now, in answer to another question by Mr. Hankin this forenoon in regard to Exhibit 74, you made some reference to the point that that Exhibit, you understand, assumed a certain amount of "coordination" between the operation by the Government at Buggs Island and the operation by VEPCO at the Roanoke Rapids plant.

[3432] Will you state to what extent do you understand or interpret Exhibit 74 to assume any such coordination?

A. The only coordination applicable there—rather, it relates to the releases which were assumed in Exhibit 10, and the coordination relates only to the loading of the load curve, if the energy were provided to VEPCO.

It had nothing to do with any particular month-by-month requirement of VEPCO based on the release which the War Department assumed in Exhibit 10.

Q. In your reference to a certain amount of such coordination, did you have in mind the existence of

any contract between the government with respect to Buggs Island releases, and VEPCO?

A. No.

* * * * *

Mr. GATCHELL. I have a number of questions, Mr. Examiner, but it might shorten it if I could have an opportunity of consulting with the witness.

Would this be a convenient time?

Mr. HANKIN. I certainly would object to that.

PRESIDING EXAMINER. I have 15 minutes more before I must take a recess, and I do wish we could utilize that.

Mr. GATCHELL. I will, then.

* * * * *

[3441] Re-cross-examination by Mr. HANKIN:

Q. From your answers given to Mr. Moore, I take it that there are some statements made by Mr. Cary with which you do not disagree, is that correct?

A. Whatever I said, the record shows. I don't recall exactly what I said.

Q. Now, I asked you whether you agree with Mr. Mr. Cary's testimony on page 2287 of the transcript, and you stated that you did not agree with his testimony, and then Mr. Moore asked [3442] you whether you disagreed with that testimony, and, as I recall, you stated that you did not disagree with that testimony as you would have testified. Let us be clear on this thing.

I asked you whether you agreed with the testimony given by Mr. Cary on page 2287 as he gave it, which is it? Do you or do you not agree with it?

A. As I gave my response to Mr. Moore, my interpretation of what certain——

* * * * *

CHIEF PRESIDING EXAMINER. Please answer as directly as you can.

The WITNESS. That is what I am trying to do. As I recall I told Mr. Moore that Exhibit 74 would apply—it would represent operation if water were available for that condition, and 61, if it were available for that condition. I want to qualify my understanding of "hypothetical condition." It is not clear to me as it is in the record. It means to me an assumption as to operation, or an assumption as to what has to be met to meet a certain condition.

[3443] By Mr. HANKIN:

Q. Now, when he testified on page 2287, did he put in any conditions as to availability of water? Let us first take Exhibit 74. With reference to Exhibit 74 he says, and I quote, "Exhibit 74 for the month of December is intended not to show the hypothetical condition, but our best estimate of conditions that are expected to actually take place in December 1953," and he says that that will be the exhibit which will apply to both average and critical flow periods. Do you agree with that statement?

A. If the water is available to permit the carrying of the load as shown by Exhibit 74, then that would be the operation. If there are other amounts of water available, there will be some other operation. Now, on his part, as I understand it, this is what he estimates would be the water released.

Q. Did he say that that is the estimate of the releases of water?

A. He says our estimate of conditions actually expected to take place. That means he expects to have the water to go with that particular condition. That is what it means to me, otherwise you couldn't carry that type of load.

Q. And Exhibit 74 is what he expected to be the conditions so as to be able to operate actually?

A. If you follow Exhibit No. 10.

Q. Now, with reference to Exhibit 61, did he say that [3444] that is the way they actually intend to operate the project in December 1953?

A. Based on the flows which were taken from Exhibit 10, you could not operate under Exhibit 61.

* * * * *

[3445] By Mr. HANKIN:

Q. Dr. Jessel, this is what Mr. Cary testified on page 2287, and I quote: "Exhibit 61 shows a hypothetical condition to illustrate the extreme effect of a sharp variation in load which shows the effect of a sharp variation on the requirement for gradual change in the rate of flow from the limitations in Exhibit 8, the letter from the Army Engineers. The hypothetical condition there was not intended to represent the actual condition, but simply to show that the project would operate with a very rapid change with that limitation applied to it. Exhibit 74 for the month of December is intended not to show the hypothetical condition, but our best estimate of conditions that are expected to actually take place in December 1953."

Now, with that testimony as is, and without any supplying of additional material, do you or do you not agree with that statement?

A. I don't know how to interpret what he means by hypothetical condition. For example, if you have one set of flows, you only can have one operating condition; now if you have two possible load curves, you operate under one or the other. I don't know what the intention or interpretation here as to [3446] hypothetical condition is. To me it has no meaning as such.

I always contend that for any one set of flows, you have a certain operating condition going with it. Once you fix that flow condition, any other condition which you may want to consider will be hypothetical, to my way of thinking, for that particular flow. If you pick some other flow, you have some other operation that goes with that, and every other condition would be hypothetical for that particular flow. You keep on going ad infinitum.

Q. In other words, what you are saying is if there is enough water to operate for Exhibit 74, that is the actual curve, and 61 is hypothetical, and when you can operate according to Exhibit 61, 61 is actual and 74 is not?

A. Because you can't be in two places at once. You have to be on one curve to go with one set of water conditions. You can't be in more than one place.

Q. I asked you a question. Is that correct?

A. I don't like the term "hypothetical condition" because it is confusing to me. What I want to say

is that the position on the load where you operate is determined by the water available.

Q. Then you don't agree?

A. I don't disagree, if I interpret his statement a certain way. In other words, if he means that for a given flow which makes the load to be carried by Exhibit 74 unpracticable, [3447] then it can't be on the part of the load curve shown by Exhibit 61, and in that instance it is hypothetical. It doesn't mean anything with regard to the flows required to operate under Exhibit 74. I don't know what he meant. That is my interpretation of what he means.

Q. You can't disagree with him because you don't know what he meant.

A. Not by that terminology.

Q. Can you agree with him when you don't know what he meant?

A. I could if I interpret the words a certain way. It is a question of how you interpret them. I think that was a question to be asked of him, what he meant, not of me.

Q. Now you say that you can't either agree or disagree with him because you don't know what he meant?

A. I say that on those two words, if he meant that Exhibit 74 would be the required operation with the amount of water available, then I say 61 is not applicable, or hypothetical, if you want to call it that. If the water conditions are such you have got to operate under Exhibit 61, then 74 is hypothetical. That is the only meaning it has to me.

Q. Doesn't your statement mean that whenever you have the water to operate according to a set curve, you can operate on that curve?

A. Yes; that is a practical approach to it, you operate [3448] according to the amount of water available.

Q. Can you start with less than a full storage reservoir?

A. You could or could not, depending on what week you are in. It may be a better condition because you have already passed your week and then gone into a low-energy condition. It depends on the situation.

Q. You mean there may be times when you may be better off starting with less than a full reservoir?

A. You could be better off, if you take a selected period of time. On an over-all basis, I would say not. It is a question of what interval of time you are considering for your study.

Q. Would you please explain a condition where you would be better off if you had less water in the reservoir than if you had a full reservoir?

A. For example, if you come out of a week end, you have no load over a week end, you would probably be better off to come in to a week end with less than a full reservoir, or you may have gone through a peak week period, and the following week may include Christmas, for example, when the energy drops off. In that week you don't have need for a full pond.

[3449] Q. But how would you be better off?

A. You are better off in the over-all picture. It depends on what period, what load study you are making. You begin the first period with a full reser-

voir and run through the first week. You may find that rather than come back to full storage it would better to let it run down for a second week before you fill up. The situation itself and the load condition will determine whether you should refill each week or run a two-week period. You can't make an assumption whether you are better off without knowing what has been before and what is coming after.

Q. I am asking now if you should start off on a Monday, let us say—because on Sunday you don't have any peaking operations. Can you give me a condition or a situation where you might be better off by having less than the full reservoir than by having a full reservoir?

A. Yes. For example, suppose we made for Exhibit 80 a month-by-month study, and the third week was a peak week, then with the greater use in the third week of energy we may have increased the capacity over Exhibit 79, so that your need for storage in the last week and the fourth week would not be there, but by using it more in the third week you can get more over-all benefit for the month.

Q. That simply means you wouldn't be any worse off if you started with less.

[3450] A. Yes; you would, because if you used less storage in the third week when you had the peak, you might have had less available capacity, and would have carried over storage to the fourth week when you didn't need so much, so you would be worse off.

Q. You would be worse off if you started the third week with a full reservoir.

A. You could be worse off; yes.

* * * * *

TESTIMONY OF MR. SUNDA

[3008] Direct examination by MR. COSTELLO:

* * * * *

[3010] Q. Have you examined Exhibits Nos. 80 and 81, introduced by the witness Hamilton, as evidence?

A. Yes, I have.

[3011] Q. Do you agree with his testimony that the Roanoke project requires water from the Buggs Island project over and above the natural flow of the Roanoke River during the critical week of adverse flow in December 1917, to make the project dependable on applicant's system load?

A. No; I do not.

Q. Why do you not agree to that?

A. I have made a study to show that the Roanoke Rapids project is dependable on applicant's system load with the natural flow of the Roanoke River during the critical week of adverse flow in December 1917.

Q. Will you please summarize briefly the results of this study?

A. Dr. Jessel has testified that 909,000 kilowatt-hours of energy must be generated by the project in a week of December 1953, to meet the system peak demand and make the project dependable to 91,000 kilowatts on the applicant's system load. Considering the 500 second-feet continuous minimum release which generates a constant output of about

2,650 kilowatts, the energy demand for peaking is reduced to about 839,000 kilowatt-hours.

In order to generate 839,000 kilowatt-hours in a December week, a flow of about 6,620 day second-feet of water would be required. A continuous minimum release of 500 second-feet requires a flow of 3,500 day-second-feet in one week. Flow [3012] requirements for both peak energy and continuous minimum releases would be about 10,120-day-second-feet in a December week.

Examination of Exhibit No. 80 shows that the week of most adverse flow is the week of December 24 to 30, with a total flow of 7,700 day-second-feet. The natural flow in the previous week was 14,850 day-second-feet, which was about 4,720 day-second-feet in excess of the requirement for peaking power and continuous minimum releases.

With this flow in excess of requirements during the previous week, the reservoir would be full at the end of the week, which would make at least 5,000 day-second-feet available in addition to the natural flow of 7,700 day-second-feet, giving a total of about 12,700 day-second-feet available during the week for peak energy and continuous minimum releases.

The amount of water in excess of requirements is 2,580 day-second-feet, and would be available for pondage for the following week, starting with December 31.

Q. Were the stream flows of December 1917 characteristc of flows which might be expected to occur in December of any year?

A. No; they are not.

Q. Will your describe the conditions accompanying the flows of December 1917?

A. Water Supply Paper 472 of the U. S. Geological [3013] Survey, in evidence as Item B by reference, which contains the stream flow records of the Roanoke River at Old Gaston, North Carolina, for December 1917, contains the following note:

> Discharge estimated, because of ice, as in table for December 12–13, 18–28, 30–31, and January 1–29, from observers' notes, weather records, and comparison with records at other stations.

Q. What have you to say with respect to ice conditions in the Roanoke River in the vicinity of Roanoke Rapids?

A. I testified on page 1862 of the transcript that ice conditions in the Roanoke River in the vicinity of Roanoke Rapids are infrequent.

Q. Should a condition of such as freezing for a short period in the Roanoke River be considered as affecting the determination of dependable capacity for the Roanoke Rapids project?

A. Dr. Jessel testified, on page 1877 of the transcript, that freezing should not enter into the determination of dependable capacity.

* * * * *

[3457] Cross-examination by Mr. HANKIN:

Q. You were present at the hearing on June 16, 1949, when Mr. Cary testified concerning Exhibits 61 and 74?

A. I was.

Q. Do you agree with Mr. Cary's testimony in response to the questions asked of him on page 2287 of the transcript, why it was that the December chart, that is Exhibit 74, was not identical in appearance with Exhibit 61. Are you acquainted with that testimony, or shall I read it to you?

A. Not the exact testimony, no.

Q. Then I shall read it. He testified as follows——

* * * * *

Q. If you will note on that page he testified as follows:

> Exhibit 61 shows a hypothetical condition to illustrate the extreme effect of the sharp variation in load [3458] and to show the effect of a sharp variation in the requirement for a gradual change in the rate flow from the limitations recommended in Exhibit 8, the letter from the Army Engineers. The hypothetical condition there was not intended to represent the actual condition, but simply to show that the project could operate with very rapid change in ouput with that limitation applied to it.
>
> Exhibit 74 for the month of December is intended not to show the hypothetical condition but our best estimate of conditions that are expected to actually take place in December 1953.

Do you agree with that?

A. Not necessarily; no.

Q. Now, assuming that Mr. Cary was right that Exhibit 74 represents the best estimate of the actual conditions under which the Applicant's Roanoke Rapids project will be operated in a critical week of

December, will you explain the statement you made on page 3009 of the transcript that you do not agree with Mr. Hamilton's testimony to the effect that the Roanoke Rapids project will require more than 4,310 c. f. s. average daily flow to make the Roanoke Rapids project dependable assuming a continuous flow of 2,500 c. f. s. for navigation purposes?

* * * * *

[3459] The WITNESS. In our computations, we did not accept Exhibit 74 as being the exhibit to determine dependable capacity of the project.

By Mr. HANKIN:

Q. But assuming that Exhibit 74 is the correct exhibit to be followed, then would your criticism still hold about Mr. Hamilton's testimony?

A. If you accept the conditions of Exhibit 74, then Mr. Hamilton's testimony has some merit.

Q. You testified on page 3009, referring to pages 583 and 584 of the transcript, that the Commission's Staff had determined that this project would have a dependable capacity of 91,000 kw. during the critical period from April 25, 1930, to March 22, 1931. Upon what data did the Staff arrive at this conclusion, for what interval of time was such capacity found to be dependable and for what period?

A. Dr. Jessel gave the information on dependable capacity to me as being the member of the Staff to determine this particular factor for our section. I myself made no computations.

* * * * *

[3462] Q. I take it that in testifying about the study made, as you testified on pages 3009 and 3010 of the

transcript, that you would have a dependable capacity of 91,000 kw. if you operate the project with a pattern shown on Exhibit 61, and not on Exhibit 74?

A. Not necessarily on Exhibit 61; but not on 74, either.

Q. How about during the critical periods?

A. The same answer goes.

Q. Now, on pages 3011 and 3012 of the transcript you explained why you did not agree with Mr. Hamilton's testimony as illustrated by Exhibits 80 and 81. Doesn't your explanation [3463] assume a pattern of operations other than Exhibit 74?

A. It does.

Q. Therefore, does it not follow that your study or results can't contradict the facts shown on Exhibits 80 and 81, since they are based on a different fundamental assumption?

A. His assumption is based on Exhibit 74; mine was not.

Q. On page 3012, you were asked to describe the conditions which obtained on the Roanoke River during the month of December 1917, and you pointed out that on certain days of that month there were ice formations on that stream; that those ice formations were infrequent, and therefore such a condition should not be considered in the determination of dependable capacity of the Roanoke Rapids project.

Suppose that ice conditions are infrequent. Does not the project nevertheless have to meet such conditions?

A. Not necessarily; no.

Q. What would you do about the ice if it comes?

A. The occurrence of ice would be equivalent to a condition of a steam plant going out of service, a blown-out boiler or some other emergency which occurs infrequently. The applicant testified that he has or will have enough spinning reserve at that time to take care of 100,000 kilowatts, as I recall.

Q. Is it your understanding that Mr. Hamilton's conclusions [3464] as to the deficiency of dependable capacity of the project, according to Exhibit 80, was influenced by the ice conditions in the month of December 1917?

* * * * *

The WITNESS. Since he used the month of December 1917, the ice conditions wouldn't have influenced his answers.

By Mr. HANKIN:

Q. As a matter of fact, how much did he say he estimated the deficiency in capacity to be; do you happen to remember?

A. I don't recall the figure.

Q. And you don't remember on what he based his conclusion?

A. He used Exhibit 74 in arriving at his conclusions. We do not accept his Exhibit 74 as it——

* * * * *

The WITNESS. I wanted to say we did not use Exhibit 74 as our criteria to determine the minimum capacity.

By Mr. HANKIN:

Q. As a matter of fact, did he not state he arrived at the conclusion as to the deficiency on the average of the low-water [3465] years and not on the most critical December period?

A. Exhibits 80 and 81 are based on December 1917. That is the only thing I have to go by.

Q. You don't recall his testimony?

A. Not the specific statement; no.

Q. I refer you to the United States Geological Survey Bulletin for the month of December 1930. Were there any ice conditions during that month?

A. There were not.

Q. Are you also of the opinion that 7,166 c. f. s. days, rather than 5,000 c. f. s. days, should be used as the usable storage in determining the dependable capacity of the project?

A. The amount—the 5,000 c. f. s. days can be taken as the pondage to determine dependable capacity.

Mr. HANKIN. If Your Honor please, I should like to ask to have marked for identification two exhibits. One is entitled "Dependable capacity of proposed project at Roanoke Rapids with the natural flow conditions of the month of December 1930, and using minimum release of 500 c. f. s. using the load pattern in Exhibit 74; Power Storage in Reservoir 7,166 c. f. s. days," to be marked as Exhibit 80–B.

CHIEF PRESIDING EXAMINER. It will be so marked for identification.

* * * * *

[3466] Mr. HANKIN. I should also like to have marked for identification an exhibit entitled "Dependable capacity of proposed project at Roanoke Rapids with the natural flow of the month of December 1930, and using minimum release of 500 c. f. s., using a load pattern 0.4033 times the load pattern in Exhibit 74, Power Storage in Reservoir, 7166 c. f. s. days," to be marked as Exhibit 81–B for identification.

CHIEF PRESIDING EXAMINER. It will be marked so for identification only.

* * * * *

Mr. HANKIN. I take it that in this case, as in the previous cases, the witness will not be permitted to state what he sees on this exhibit, and counsel will not be permitted to make an offer of proof?

CHIEF PRESIDING EXAMINER. It would be too confusing to the record to have this witness, who is now in cross examination, examined upon a paper which, according to the ruling of this [3467] Examiner, will not be in the record.

Also, the Secretary of the Interior has completed the offering of his evidence in June, the evidence which the Commission in its great liberality reopened the case to receive, and therefore we are now in the closing day of this hearing.

Counsel for the Secretary of the Interior is cross-examining the final rebuttal witnesses of the applicant, who bears the general burden of proof, and inasmuch as there is no prospect in this Examiner's judgment, according to his ruling, that this paper now marked for identification will become a part of the

evidence in this case, inasmuch as the Secretary of the Interior is through with the offering of evidence, there will be no purpose whatever in receiving an extended offer of proof in regard to it, because the paper will not get into the record; not because of any inherent defects it may possess, because I have not examined it, but because the Secretary of the Interior is through with offering evidence under the scheme laid down in the reopened hearing.

The Secretary of the Interior was permitted in June to offer everything that he desired after the case had been closed, and a fair hearing already held last year.

Now the applicant, bearing the general burden of proof, is closing the case with the offer of his evidence on rebuttal. The Secretary of the Interior is now cross-examining these [3468] rebuttal witnesses I do therefore reject your offer of proof.

Mr. HANKIN. Your Honor made a statement to the effect that you do not want counsel for the Secretary of the Interior to make an extended offer of proof. As a matter of fact, all I was going to do was to point out that the deficiency in the dependable capacity shown on that exhibit is greater than that testified to by Mr. Hamilton, namely, 75,000 kw.

CHIEF PRESIDING EXAMINER. It is not necessary to have this paper to cross-examine with respect to that, and this paper would be confusing. I therefore ask counsel to proceed according to my ruling. I give him his exception on all counts.

* * * * *

[3470] Q. Now, my second point which I should like to ask you to clarify is this:

You state the project will have a dependable capacity of 91,000 kw. if operated in the week of annual peak in December under adverse water conditions in accordance with Exhibit 61, but not if operated in accordance with Exhibit 74; is that correct?

A. Where is that statement, Mr. Hankin?

Q. On page 3017.

A. I don't see that statement in here; as you stated it.

Q. I am referring to lines 8 through 11.

* * * * *

The WITNESS. I stated that Exhibit 61 is a possible method of operation of the Roanoke Rapids project under adverse flow conditions.. The operation of Exhibit 74 would not be [3471] used under similar conditions.

* * * * *

Q. Third, you refer to Mr. Creim's statement on page 2499, line 23, of the transcript, and quote him as saying that—and I am now quoting you: "He intends in the operation of Buggs Island to pass an amount of water equivalent to the natural flow of the river."

Is it your understanding that he would at all times pass the natural flow, or that in the aggregate of the period of time, a day, or two days, or sometimes three, the amount of water passed would be equivalent to at least the natural flow of the river?

A. My interpretation of that is that he would not release the natural flow at all times. As to what period, or during what periods it would be released, is something I can't say. It would be assumed that it would be during the low-water flow, particularly; whether three or four days, or a month; that is something which I can't say.

Q. And, as a matter of fact, Mr. Creim testified as to conditions where that release might not be possible.

A. He stated he would release the natural flow of the river. Any other statement would be contradictory.

Q. I refer to his statement on page 2495 of the transcript, where Mr. Creim testified as follows:

> [3472] I can visualize a regularly occurring week end and holiday situation when the power production for the Southeastern System would be produced primarily from steam and Diesel, and generation at Buggs Island would be kept at a minimum to conserve water. I can also visualize a situation where through an extended dry cycle, the Southeastern Power System would be operated with all possible steam, operating at base load, with only incidental peaking at the Buggs Island plant. Either of these operations would materially reduce the amount of water released at Buggs Island, and could create a deficiency in water supply for the operations of Roanoke Rapids.

In view of this testimony, could you state as you stated on page 3018 that there would be more than ample water "to enable the applicant to utilize the

full dependable capacity of 91,000 kilowatts for the proposed Roanoke Rapids plant without any additional releases from the Buggs Island Reservoir."?

A. Based on Mr. Creim's statement on page 2499, line 23, that statement on 3018 would still hold good.

Q. How about it when based on the statement of Mr. Creim on page 2495; would that still hold true?

A. Not knowing what his releases would be, I can't say.

Q. Now, the fourth point is this: You stated that there will be no necessity for any agreement with the United States [3473] to assure an adequate supply of water for operation of the Roanoke Rapids project. This conclusion is based, I take it, on the assumption that Exhibit 74 is not representative of the actual operations, but that the project would be operated according to some other pattern like Exhibit 61 in periods of low flow; is that correct?

A. The conclusion is based that the project would not operate according to Exhibit 74, but neither would it necessarily operate according to Exhibit 61.

* * * * *

[3475] Q. You state that if there were any benefits conferred upon the Roanoke Rapids project by the storage and release of water at the Buggs Island project, "I would fully expect the Federal Power Commission to assess and collect charges for such head water benefits as is required by section 10 (f) of the [3476] Federal Power Act." I take it that by the phrase "I would fully expect the Federal Power Commission" to do thus and so, you mean

that you assume the Commission would do it, or do you means that you would require it to do it?

A. The Commission has in the past made studies of headwater benefits. Whether the operator at the Buggs Island project would request the Commission to make a study, or whether it would be made on its own initiative, I can't say. That is for the Commission to decide.

Q. At any rate, you don't know of any power or authority that can compel the Commission to do it?

A. That is a legal point. I couldn't say.

Q. I agree with you it is, but you testified as to this legal point.

In connection with this matter, Mr. Sunda, you would not recommend that any headwater benefit payments be assessed for any contribution of capacity to Buggs Island, would you, but only for an initial energy that might be generated?

A. Based on our present studies, there will be no benefits of capacity. However, I can visualize at a future date the position may change. Based on our present studies, there is nothing to show that that would occur.

Q. In how many cases in the 30 years of the existence of the Federal Power Commission has the Commission assessed headwater benefits?

[3477] A. On government-owned projects, to my knowledge there are none at the present time, although there is one that is under study at the present time.

Q. That doesn't answer my question. In how many cases has the Commission actually assessed headwater benefits in the past 30 years?

A. Between five companies, there is one case.

Q. That number of assessments is out of how many licensed projects?

A. I wouldn't say.

Q. In view of this fact, what is your basis for saying that you would fully expect the Federal Power Commission to assess and collect charges for such headwater benefits as required by Section 10 (f) of the Federal Power Act?

A. To date there has been no case where a government project benefits a downstream project which would justify making a headwater benefit study.

Q. Doesn't my question apply equally to government and nongovernment cases?

A. In the case of nongovernment cases, it would appear to me that unless the Commission is actually requested by someone who claims he is giving benefits to make a determination, there is no requirement on the part of the Commission to make such determination.

Q. You are again testifying as a matter of law, aren't you?

[3478] A. I am answering your question to the best of my ability.

Q. I asked about the basis for your expectation, but that is all right. I will accept that as an answer.

Mr. Sunda, you were present at the hearing on June 12 when Mr. Creim testified in this matter?

A. I was.

Q. And you were present at the hearing on June 15 when Mr. Hamilton testified in this matter?

A. I was.

Q. On page 3018, referring to your expectation that the Federal Power Commission would assess and collect headwater benefits, you added, and I quote you, "A matter to which I did not hear Mr. Creim refer while he was on the stand." Was that an observation of fact or an argument on your part?

A. An observation of fact. There was no argument involved.

Q. You don't know whether there was any obligation on the part of Mr. Creim or Mr. Hamilton to testify on this matter?

A. They, in determining the feasibility of the Roanoke Rapids project pointed out the benefits which under their method of operation applying Exhibit 74, the amount of benefits which the Roanoke Rapids would supposedly obtain from the Buggs Island project. These can be interpreted as being headwater benefits.

Q. So, what you meant was not that Mr. Creim did not refer to the obligation of the Commission to impose headwater [3479] benefits, but that you said you did not hear him testify on the subject of headwater benefits, is that correct?

A. He had no testimony pertaining to headwater benefits, except as he referred to the possible benefits derived by the Roanoke Rapids project under his method of operation.

Q. Now, as a matter of fact, Mr. Sunda, did not Mr. Creim testify on page 2494 of the transcript that

as compared with natural flow conditions, the Roanoke Rapids project would benefit from Buggs Island in capacity to the extent of $1,690,000 per year, and that the difference between the benefits from Buggs Island with and without special regulation of the flow, the benefits would amount to $901,600 per year, is that not so?

A. He testified as to the value of the capacity which Roanoke Rapids would obtain from the Buggs Island project based on operations under Exhibit 74.

Q. And therefore there was no occasion for you to say "a matter to which I did not hear Mr. Creim refer while he was on the stand"?

A. Mr. Creim only referred to the possible value of capacity which he indicated in his Exhibit 87, the Roanoke Rapids project would obtain from Buggs Island.

However, the benefits which he referred to, and the headwater benefits which the Commission computes are entirely on a different basis.

Q. When you say you did not hear him refer to this matter, [3480] you meant you did not hear him testify in accordance with the basis which you would testify on with reference to headwater benefits payments; is that correct?

A. His interpretation of headwater benefits and mine are probably different.

Q. But he did refer to the subject?

A. Not as such; no.

Q. I shall take that as your answer. Now, did not Mr. Hamilton testify on page 2871, through the first

line on page 2873, to the effect that the contribution of Buggs Island to Roanoke Rapids would be as much as $1,955,000 per year—that is including both capacity and energy, but that he had previously testified that the minimum headwater benefit payments would be only $690,000 per year because he was acting under instruction of counsel as to what Section 10 (f) of the Federal Power Act required?

A. May I have the reference again?

Q. 2871 through the first line on page 2873.

* * * * * *

[3483] Q. Suppose you had a steam plant with a rated capacity of 91,000 kw. For how many hours during the year would that capacity be dependable?

A. Most of the time.

Q. Would you say that the dependable capacity of the steam plant would have to be dependable upon the load of the VEPCO System, or is that steam plant dependable in the amount of 91,000 for most of the time irrespective of what the load curve of the VEPCO System may be?

A. The capability is there most of the time, irrespective of the load curve, that is true.

Q. Suppose you had a steam plant with a rated capacity of 91,000 kw. Wouldn't the value of that capacity be 91,000 times $22.54, or $2,052,140, subject to check?

A. The value of the capacity would be 91,000 times $22.54.

Q. And that is over $2,000,000.

A. Well, whatever it becomes.

Q. Is it not true, Mr. Sunda, that the capacity of such a steam plant has a value of over $2,000,000, because you can always depend upon the availability of that capacity of 91,000 kw. from that plant?

[3484] A. Not necessarily. You need your capacity. You don't have to depend on it at all times, just at certain times. The fact that it is available at all times has no significance as to the dependable capacity value.

Q. Suppose you had two steam plants, both with a rated capacity of 91,000 kw., and that in the case of one plant you can depend upon the availability of that capacity at all times, but that in the case of the other steam plant, you can't depend upon the availability of that capacity except for four hours during the year. Would you say that the capacities of the two plants are equal in value?

A. They are.

* * * * *

[3485] Q. Let me ask you this hypothetical question:

Suppose Mr. Smith, an industrialist, contracted to purchase 91,000 kw. of capacity and 333 million kw.-h. of energy so that he might use that power in his large industrial plant.

Suppose that the industrial plant operates with the use of electric power at a nonuniform rate. He therefore contracts for the purchase of 91,000 kw, because he figures that that would be the amount of capacity he would need at his busiest hours.

After having entered into such a contract, would he not expect that a capacity of 91,000 kw. would be

available to him whenever those busiest hours occurred?

A. Under that contract he would expect that the 91,000 kw. would be available to him at all times.

Q. Now, let us supose that after having entered into such contract, he finds that 91,000 kw. is available to him only four hours per year. Would such capacity be worth over $2 million a year to him?

A. If the conditions are different, the value would not be there.

Q. Do you agree with the following statement made by Dr. Jessel on page 862 of the transcript; and I quote:

> In utility practice, dependable capacity is that capacity which can be called upon for carrying load, and it has associated with it full capacity value. In other [3486] words, should that capacity be not available it would be substituted for by steam electric capacity, and would have less value as to the capacity component.
>
> If it is not dependable, does it have the same value?"
>
> And the answer is "No, sir; practically nothing."
>
> Question: It has got no value if it is not dependable?
>
> Answer: Yes; because if it is not dependable, it is not available when required. That in turn means that the system utilizing that capacity would have to proyide the full amount required when the hydro is not available, so it would be unfair to give it any appreciable value because the investment has to be duplicated.

Do you agree with that statement?

A. I have no argument with the statement at all.

Q. Now, so far as Mr. Smith in our hypothetical case is concerned, so long as the capacity is available, it makes no difference to him; does it, whether it is available from one plant or another, and if the capacity from one plant is not available but a supply from another plant, then the capacity of the other plant is not worth anything additional to him; is that not so?

* * * * *

[3487] The WITNESS. Mr. Smith is not concerned where the power comes from. All he cares is to get the 91,000 kilowatts.

However, in this case, the Virginia Electric and Power Company, who are supplying the power or energy in this case, or both, are responsible to supply him that capacity and energy. They can supply it through steam plants or through hydro plants, whichever they have available at the time they put the energy out, and the capacity. Therefore, I can't answer your question in that respect, because Mr. Smith had nothing to do at all as to where the energy comes from. It is entirely up to the power company who are supplying the power to furnish it to him.

By Mr. HANKIN:

Q. All I asked was whether that supplemental capacity was [3488] worth anything to him. I believe you answered that in the negative.

A. I made no answer in that respect?

Q. You have not?

A. My answer was complete there, I believe. He relies on his supply from the VEPCO system.

Q. But, so far as he is concerned, when one plant can't furnish the capacity and it is furnished by another, that is all he cares for?

A. There is no assumption here that one plant had to furnish the capacity. He is getting his 91,000 capacity, and it doesn't make any difference where it is from.

Q. At any rate, it might make no difference to him whether all or part of the capacity came to him from a steam or hydro plant; would it?

A. It would make no difference.

Q. On page 3017 of the transcript you were asked whether there was an exhibit in the record that showed the VEPCO load and the operation of the Roanoke Rapids project on the system peak. Your answer was that Exhibit 92 contained an estimated weekly load curve for December 1953, and I quote you: "—Exhibit No. 61 shows a possible operation of Project No. 2009 in the week of annual peak in December 1953, under adverse flow conditions;" is that right?

Q. Now, when you say a possible operation, do you agree with [3489] Dr. Jessel's statement on page 3000 to 3001 to the effect that Exhibit 61 represents the 91,000 kilowatts section from a system peak of the Virginia Electric and Power Company for December 1953, and Exhibit 74 represents the 96,000 kilowatt block load section at the load position on the same load curve, or do you mean that Exhibit 61 is a pos-

sible but not an actual estimate of operation as testified by Mr. Cary on page 2287 of the transcript?

A. My opinion of Exhibit 61 is that it is a possible method of operation, and the actual operation would depend entirely on the water available at the particular time when the load curve on 92 would occur?

Q. Now, which do you agree with: Dr. Jessel or Mr. Cary?

A. I have my own interpretation, Mr. Hankin, and I do not wish to try to come between either one of them.

* * * * *

Q. Will you refer to Exhibit 92, and state what is represented by the cross-hatched area, and what is represented by the solid black areas?

A. The cross-hatched area, to my knowledge, is the energy and capacity which is shown on Exhibit 74, except the fact that the base load, that is, the load based on a [3490] continuous flow, is not included in there, and also the energy required due to limitation of flow.

The top; that black area, shows the exhibit 61, with the exception of the base load of the continuous flow, and also the energy in the blocks which would be required by limitation of releases.

Q. Now, the project would not be operated according to Exhibit 74 and according to Exhibit 61 at the same time; would it?

A. No.

Q. Now, when the project is moved out of the cross-hatched area, what will supply the power for that part of the load curve?

A. It is assumed that the Virginia Electric and Power Company has at this particular December week, December 1953, 720,000 kilowatts of capacity. If you have the cross-hatched area operated by the hydro-plant, then the top area represented by the black top part would be represented by steam plant, or some other method of generation.

If we move the hydro from the lower area, and shift it to the upper area, or the darker area, then the steam which is up in the upper area would be moved back down, and occupy the cross-hatched area.

Q. In other words, you would use the steam plant?

A. Don't misinterpret me. I have made my full explana-[3491]tion, Mr. Hankin.

Q. I am not misinterpreting you at all. Tell me this:

How about that steam plant? Does the capacity of that steam plant have to be available all of the time so that whenever you move the project out of the cross-hatched area you will be able to substitute it?

A. The capacity is already there. You are not holding back any additional capacity. As I said, VEPCO in this case would have a capacity available of 720,000 kilowatts, plus their spinning reserve. That is all the capacity it would have. There would be no additional capacity to stand by this 91,000, so that if you take this capacity from below, you would shift it up to the top to take the capacity from the top and shift it down below. It would be a question of shifting, and you would not require additional capacity.

Q. That is an enlightening answer, but my question is this:

Would that capacity, which would have to take the place of the hydro project in the cross-hatched area have to be available all of the time?

A. It is available.

Q. It would have to be available?

A. Well, it is available.

Q. Do you make a distinction between the two?

[3492] A. Yes; I do.

Q. What is the distinction?

A. The distinction that you already have it there, and you are not requiring additional capacity.

Q. Now, then, is the capacity of that steam-plant worth $22.54 per kilowatt?

A. What steam plant?

Q. The one that you would operate when the hydro plant is moved out of the cross-hatched area.

A. I did not say we would have a hydro plant move in where the cross-hatched area moved out. You have a steam plant already in the system, and its value would be about $22.54 per kilowatt; yes.

Q. I didn't quite understand your prefatory remark. You didn't say that the steam plant would be moved in when the hydro plant is out. You simply can't have that area remain idle, can you?

A. I believe I made myself clear, or I tried to, Mr. Hankin; that as you move the hydro out of the cross-hatched area, you move it higher on the load curve—in your respect, you say move it on to the top—and at the same time you are moving that hydro higher up; you are taking steam which is already up on

the top and moving it down, so you have no additional capacity to replace this hydro, which is down below. It is already there on the system.

[3493] Q. Now, then, I ask you whether the capacity of that steam plant which you would operate would have a value of 91,000 times $22.54?

A. The value of all the capacity which is for the 720,000 would likewise have a value of $22.54 per kilowatt.

Q. When you say all the capacity, you mean the capacity that you move into the cross-hatched area when you move out the hydro plant?

My question was limited to that, Mr. Sunda.

A. Any capacity——

Q. I don't want to know about any capacity. I want to know about the capacity that you move into the cross-hatched area when you move the hydro plant out of it.

A. You can't put your finger on any particular steam capacity which is moved either in or out. It is already there in the first place. You just transpose the positions.

Q. You mean the capacity of the steam plant is already there while the hydro plant is there?

A. That is right; in the system, not in that particular area, no; in the entire system.

Q. I am talking about the cross-hatched area.

Now, if you don't want to answer my question——

A. I am answering your question.

Q. You are not; you are talking about the entire load curve.

[3494] CHIEF PRESIDING EXAMINER. I think he has answered your question at least three times in the last 15 minutes. It has now become very argumentative. I will ask you to go on.

By Mr. HANKIN:

Q. Assuming that the value of the capacity of the steam plant will be 91,000 times $22.54, what will be the value of the capacity of the hydro plant which will not be operated in the cross-hatched area when the hydro capacity is not available?

A. The hydro capacity is available, and the value would be $22.54 times the 91,000.

Q. You mean it will be available for that cross-hatched area?

A. Not for the cross-hatched area. It would be available in that case, if you move it out of the cross-hatched area, it would be available for the blackened area.

Q. Assuming that the capacity of the hydro plant is placed at $22.54 per kw., or a total of over $2 million, what will be the value of the capacity of the steam plant which must be available whenever the hydro capacity is not available?

A. We do not have double capacity, as I said before. The capacity just replaces itself, and the capacity which is on top before, its value is 91,000 times $22.54.

Q. I invite your attention to the following on page 868 of the transcript. There Dr. Jessel was asked "Can a [3495] purchaser afford to pay for capacity value twice, once for the hydrocapacity which is avail-

able part of the time, and again for the same steam electric capacity which is needed only part of the time?"

Dr. Jessel answered: "The purchaser would only buy, in my opinion, such amounts as would be dependable on his load. Amounts in excess of that usually come in under secondary or, rather, interchange arrangements. What he would buy would be the dependable peaking capacity which is usable on the system load. I can't conceive of him buying capacity just to have it lying around." Do you agree with that statement?

A. Under the conditions that you made in your question there, the purchaser would pay for the value of the capacity twice. He could not.

Q. Do you agree with Dr. Jessel's answer to that question?

A. In general terms; yes. I don't have the background of what he means there. I am merely saying that a purchaser can't afford to pay for capacity value twice.

* * * * *

[3498] CHIEF PRESIDING EXAMINER. Please come to order. You may proceed, Mr. Hankin.

By Mr. HANKIN:

Q. I notice, Mr. Sunda, that in the cross-hatched area the Roanoke Rapids plant has a capacity of 91,000 kw. for 47 hours during any week in December; is that correct?

A. I haven't checked it; it may be.

Q. I also notice that in the solid black areas in Exhibit 92, the Roanoke Rapids project has a capacity of 91,000 kw. for one hour on Thursday for each week in the month of December; is that right?

A. Exhibit 92 shows Thursday you have a capacity, or a requirement, not a capacity—you have a requirement of 91,000 kilowatts.

Q. Do you make a distinction between requirement and capacity?

A. Yes, I do.

Q. And are you referring now to Exhibit 92, or your interpretation of Exhibit 92?

A. I am referring to 92, and my interpretation of it.

Q. Now, let us limit ourselves to Exhibit 92. Does Exhibit 92 show a capacity of 91,000 kw. for one hour on Thursday?

A. It doesn't show capacity, it shows requirements.

Q. Do you find the word "requirements" on Exhibit 92?

[3499] A. There is no such word there. It is my interpretation of what is shown on there.

Q. I asked you to limit yourself to Exhibit 92. You say the word "requirements" is not there. Do you find the word "capacity" there?

A. The word capacity is on this sheet; yes.

Q. Now, with reference to this exhibit, will you note it says relative location of energy and capacity on Exhibit 61 with energy and capacity on Exhibit 74. Could you point out what was represented by the energy, and what is represented by the capacity?

A. I cannot show what is energy and what is capacity. All I show on here is what is required of

the plant at that particular time. The capacity may be there, in addition to that, but the requirement is only that shown on this particular sheet.

Q. But as shown on this particular sheet, what is represented by capacity, or what represents the capacity, and what represents the energy?

A. The black line is the energy. The capacity is not shown on here, in my estimation.

Q. In other words, you would say that the heading of this exhibit does not state what the exhibit actually shows?

A. This exhibit shows the energy and capacity shown on Exhibit 61, but any particular point, or any particular curve actually represents requirements of energy. You cannot actually [3500] put down and say this is the capacity at any particular time.

Q. Well, on what do you base your $22.54 per kw. of capacity?

A. On the requirements at any particular time. In this case it is 91,000, shown in this particular exhibit.

Q. But that 91,000 is capacity, isn't it?

A. It is capacity requirement; that is correct.

Q. And that 91,000 of capacity is shown in the solid black lines for how long a time?

A. The requirement for 91,000 is shown for one hour.

Q. Please don't substitute for words I use.

A. I cannot give you the other word, because the way I specify it is the way I understand the problem to be.

Q. Then please state that you do not want to answer my question; but don't substitute your own words and answer some other question.

Mr. GIBSON. I object to the argument.

CHIEF PRESIDING EXAMINER. Does that exhibit show capacity itself, or merely the requirements of capacity?

The WITNESS. Requirements of capacity.

CHIEF PRESIDING EXAMINER. That ought to be clear enough, it seems to me.

By Mr. HANKIN:

Q. Now, will you please refer to the cross-hatched area. Would you say that that represents the energy and capacity on **[3501]** Exhibit 74?

A. It shows the energy requirements shown on Exhibit 74, and the capacity of the project—the cross-hatched area does not show the entire Exhibit 74, it shows only part of Exhibit 74.

Q. Well, then, will you refer to Exhibit 61 and Exhibit 74, themselves. On Exhibit 61, would you say that the vertical lines show the capacity and that the area represents the energy?

A. The vertical line represents requirement of capacity. It doesn't show capacity itself.

Q. How do you distinguish between the requirements of capacity and capacity?

A. The capacity may be there more times than shown on here. The requirement is that part which is required of the project at any specific moment.

Q. Can you have a requirement of capacity more than the capacity of a project?

* * * * *

The WITNESS. No; you cannot.

By Mr. HANKIN:

Q. Now, when the project is operating, do you have a requirement of capacity, or the capacity of a project?

A. You may have a requirement of capacity, but it may not be the capacity of the project.

* * * * *

[3513] Q. Now, you also heard, probably, the questions that I asked of Mr. Cary, whether it would be possible to construct a steam plant with a capacity of 72,000 kw., and overload it for one hour on Thursdays, or on one hour in December when the system load requires that peak. What is your opinion as to that?

A. The 72,000 kilowatt unit would cost, with the capability of 91,000, would have a value of the same as 91,000 kilowatts, shown in the value of the hydro and the steam plant which we used in our determination of dependable capacity, and economic feasibility.

Q. How much would that be in investment per kilowatt?

A. I do not know.

Q. Have you had occasion to examine Exhibit 15 in this proceeding?

A. I am somewhat familiar with 15, not too much.

Q. Now will you look at the right-hand column on Exhibit 15. Doesn't that show the value of the equivalent steam plant?

[3514] A. That is right.

Q. Now, is that an equivalent steam plant of 91,000 kw. or 72,000 kw?

A. It says capability of 91,000. It doesn't give any rated capacity.

Q. Does that mean capability 100 per cent of the time?

A. No, not necessarily; no.

Q. Do you mean you would have a steam plant that has a capability of only for how many hours?

A. I do not know.

[3515] Q. Now, assuming that this means capability for only a short period of time, what would be the rated capacity of this project?

A. I do not know.

Q. You do not know whether the plant set forth in Exhibit 15 on the right-hand column has a rated capacity of 72,000 or 91,000 kw.

A. I do not know.

Q. How about the plant in the left-hand column, where it says "capability, 91,000." Does that have a rated capacity of 91,000, or 72,000?

A. That has an installed capacity of 91,000.

Q. Now, doesn't that apply equally to the figures in the right-hand column?

A. I do not know; I didn't prepare this exhibit.

Q. But wasn't that to be the plan; that it would be equivalent to 24-hour operation?

A. Which one is that?

Q. The one in the right-hand column?

A. 24-hour operation? 24 hours a day; yes.

Q. How about the hydroplant?

A. At certain times, also 24 hours.

Q. And wouldn't you have to have some capacity on base 24 hours a day?

A. That is quite true.

[3516] Q. Now, when you see a comparison of the two plants, one hydro and another steam, both carrying the same figure of capability, do you mean that one may have an installed capacity of 91,000, and the other one of 72,000?

A. I do not know.

Q. Do you know on what basis you compute your value of capacity of $22.54 per kw.?

A. I testified before that Dr. Jessel computed the value of capacity and energy. I got the figures from him. He has the back-up—the basis for that.

Q. Is it based on any figures as to investment and cost of investment?

A. It is based on certain value per kilowatt.

Q. Certain value per kilowatt. What is that value?

A. I do not know. It varies with the size of plant, the location within the country, and other factors which enter the picture.

Q. But you are giving a figure of $22.54 for this particular plant; is that right?

A. That is right.

* * * * *

[3518] By Mr. Gibson:

Q. Mr. Sunda, Mr. Hankin asked you whether or not you agreed with Mr. Cary's testimony as to the estimate of operation in accordance with Exhibit 74.

Referring to page 2287 of the record, as a matter of fact, Mr. Cary's testimony at that point states that it was the company's estimate, his words were "our estimate," that that [3519] would be the expected method of operation.

Do you disagree with the fact that that estimate was the company's estimate?

A. No; I do not.

Q. In expressing your possible disagreement, I think you said you did not necessarily agree. Your possible disagreement might be with the estimate itself, as I understand it?

A. My only disagreement with the estimate would be its use to determine dependable capacity of the project.

* * * * *

[3524] Mr. HANKIN. With reference to the exhibits which I asked be admitted in evidence, and which Your Honor has not accepted, and with reference to the offer of proof that I made, which Your Honor prohibited me from making, I would like to state [3525] that I have prepared a motion addressed to the Commission which I should like to read into the record because of the fact that we will probably adjourn before the motion is duplicated. It is now in the duplicating process, so if you will permit me, I shall read this motion for consideration by the Commission, so it will be in the record.

CHIEF PRESIDING EXAMINER. Why do you wish it in this record? You are addressing it to the Commission. I have no jurisdiction over it. You are filing it, I take it, directly with the Commission, aren't you?

Mr. HANKIN. It doesn't make any difference to me whether I file it directly with the Commission, or whether it is transmitted to the Commission through this record. The only thing that I am interested in

is to see to it that we are not delayed, and that the hearing is not prolonged so that it might be——

CHIEF PRESIDING EXAMINER. I don't think that is a matter proper to go into this record, because it is addressed at a level higher than this tribunal.

* * * * *

[3531] I want to say one thing further with reference to Mr. Hankin's offer of proof. I have said it before, but I would like to say it again at this juncture:

I did not reject the new exhibits which Mr. Hankin proposed, representing the Secretary of the Interior, because of their contents, because of their irrelevancy, or anything of that sort. I have not seen them. I have not examined them.

But they are left out of the record because of the necessity for concluding the case, the hearing, at some time, and getting the public's business performed. Inasmuch as I have decided that we have reached the point where it is proper to conclude the hearing, then an offer of proof with reference to anything else—when the time for all proof is over, would be utterly futile and useless, and would not serve the purpose traditionally served by an offer of proof.

The point lies on whether I am correct in concluding the hearing at this time. If so, it will be utterly futile to have someone make an offer of proof at the moment of concluding the hearing.

That is the way I look at the matter, and unless someone else has something to say, it is my intention now to adjourn.

* * * * *

[5625] ORDER ON MOTION

On July 12, 1950, the Secretary of the Interior, through his counsel filed a motion seeking review and revision of rulings of the Presiding Examiner "on the admissibility of evidence and offer of proof at the hearing reopened on June 12, 1950."

On July 14, 1950, and July 17, 1950, counsel for the Applicant, the two interveners supporting the application, and the Staff filed objections to this motion.

Denial of the motion in these circumstances does not constitute a determination of the relevancy or materiality of the documents and the offer. The Secretary is not foreclosed from presenting the data in his brief. Review and revision of these rulings of the Presiding Examiner may be urged by the Secretary in any exceptions to the intermediate decision he may desire to file with the Commission.

Upon review of the record relating to the questions raised by the motion of the Secretary, the Commission *finds:*

The rulings by the Presiding Examiner in refusing to admit in evidence certain documents marked for identification during cross-examination of adverse witnesses and in denying to Counsel for the Secretary an opportunity to make an offer of proof respecting such documents were in all respects reasonable and proper.

* * * * *

J. H. GUTRIDE,
Acting Secretary.

Date of issuance: July 19, 1950.

TESTIMONY OF MR. HOLTZCLAW

DIRECT EXAMINATION

[216] During the year 1948, Virginia Electric and Power Company purchased from the Braddock Light and Power Company at one location in Arlington County, Virginia, 149,000,000 kw.-hrs., with a demand of 34,700 kw., for which it paid the Braddock Company at the average rate of 0.98 cents per kilowatt hour.

Q. That Braddock company is a Virginia subsidiary of the Potomac Electric Power Company that serves the City of Washington and environs, is it not?

A. That is correct.

Q. And you paid that company approximately one cent or 0.98 cents per kilowatt hour for this 149,000,000 kilowatt hours in the year 1948?

A. That's right, 149,000,000 kilowatt hours received at one location.

These figures are quoted to indicate that one cent per kilowatt hour is about as low as rates go on a system such as ours with coal at about $10 per ton. But for the fact that so large a part of the company's generating plant [217] was built when construction costs were about half what they are now, a one cent rate would not be possible. Roanoke Rapids power must be based on present and future construction cost. In view of the large investment in transmission lines and substations, and in view of heavy transmission losses in transmitting small loads such great distances and provision of steam standby, it is my judgment that the cooperatives, as a whole, cannot buy at

the switchboard and transmit power developed at any dam on the Roanoke River and deliver it to their load centers at a net cost of one cent per kilowatt hour.

* * * * *

CROSS-EXAMINATION

[518] Q. You have stated that in 1948 your company purchased from the Braddock Light and Power Company in Arlington, Virginia, 149 million kilowatt hours with a demand of 34,700 kilowatts at an average price of 9.8 mills per kilowatt hour. You also stated at page 219, that your company sold to its Virginia REA Co-op customers 52,150,000 kilowatt hours, with a demand of 15,536 kilowatts. In view of these figures, do you contend [519] that the so-called one-cent rate which your company charges the co-ops is, in fact, a subsidized rate to them?

A. I would not say that.

Q. How can you reconcile the two figures that reach the conclusion you just stated?

A. It is rather hard to reconcile them.

Q. Would you care to attempt it?

A. It is not a subsidized rate, but it is a rate that is very close to cost. Every kilowatt hour that VEPCO turned out last year cost the switchboard 6.9 mills for the year 1948. The average operating expenses of the company per kilowatt hour were 1.01 cents—operating expenses, not including interest, amortization, or taxes. Operating expenses were 1.01 cents per kilowatt hour. That is kilowatt hours, generated and purchased.

We delivered to customers only 86½ percent of the kilowatt hours we generated and purchased, so as the co-ops lose in their transformation, we lose in our transformation, shipping around to the various places.

It actually cost us one-cent last year to manufacture current and distribute it.

Q. Did it cost you the one-cent or the 1.01?

A. 1.01.

Q. And you sold it at one?

A. We sold it at one to the co-ops.

* * * * *

TESTIMONY OF MR. BARNES

* * * * *

[2004] Cross-examination by Mr. HANKIN:

Q. Can you tell us what would be a fair probable error in making estimates of this character?

A. I think a ten-percent margin of error in estimating the construction costs of a project that will require approximately three years to build is a reasonable margin of error.

[2005] Q. In fact, it is a very good margin of error, isn't it, Mr. Barnes?

A. Well, I think good engineers are liable to be that far wrong.

Q. And good engineers don't control prices, do they?

A. They do not.

Q. And you would say also, I suppose, that a chain is no stronger than its weakest link?

A. I think that is an axiom that probably has been proved by time.

Q. So is the figure of $2,829,000 on Exhibit 15—do you happen to have it?

A. I haven't Exhibit 15. [Document handed to the witness.]

Q. If accurate within ten percent it is a pretty good guess or pretty good estimate, isn't it?

A. Well, there are certain elements in that that are not construction estimates. The construction cost included in that estimate is $26,738,000.

Q. That is the largest item, is it?

A. That is the largest item in that column. The largest item included in the $2,829,000 is the six percent return on that investment which is $1,604,000. So if the plant had a margin of error of ten percent in the investment cost, the fixed charge item of $1,600,000 would have a corresponding ten percent [2006] error, or $160,000.

Q. You wouldn't say that your figure of $2,829,000 is absolute, would you?

A. No; I would say it is subject to that fluctuation.

Q. And also is subject to other fluctuations concerning costs?

A. Yes; it is subject to fluctuations on account of income taxes, for example, which may be increased or decreased. The trend of the present administration, as I testified, is to increase.

Q. So how accurate do you think that figure of $2,829,000 is, within what margin of error, or what percentage of error?

A. Except for the operating expenses which I think can be fairly reasonably accurately estimated, I think it is subject to a fluctuation of ten percent.

* * * * *

Evaluation of applicant's project No. 2009, as compared with an equivalent steam plant of 91,000 kw. and 72,000 kw. (following applicant's exhibit 15)

	Roanoke Rapids hydro program	Equivalent steam program (91,000 kw.)	Equivalent steam program (72,000 kw.)
Estimated investment:			
Power development	$25,085,000	$11,757,000	[1] $9,302,400
Substation step-up and step-down	1,113,000	1,324,000	[1] 1,047,560
Transmission lines	540,000	500,000	500,000
Total	26,738,000	13,581,000	10,849,960
Assumed financing:			
55 percent debt	14,706,000	7,470,000	5,967,470
45 percent equity	12,032,000	6,111,000	4,882,480
Net return on investment, 6 percent	1,604,000	815,000	650,990
Interest on debt, 3 percent	441,000	224,000	179,020
Balance for surplus	1,163,000	591,000	481,970
Balance before Federal income tax	1,876,000	953,000	777,370
Federal income tax, 38 percent	713,000	362,000	295,400
Net return plus Federal income tax	2,317,000	1,177,000	946,390
Depreciation:			
Hydro, 58-year sinking fund at 6 percent...0.212 percent	53,000		
Steam, 35-year sinking fund at 6 percent.....897 percent		105,000	83,440
Substation, 30-year sinking fund at 6 percent 1.26 percent	14,000	17,000	13,200
Transmission line, 30/50-year sinking fund 6 percent	2,000	4,000	[2] 2,000
Property tax	304,000	99,000	[3] 78,980
Annual capital charges and taxes	2,690,000	1,402,000	1,124,000
Transmission line and substation operation and maintenance expenses	7,000	21,000	[3] 7,000
Fixed station operation and maintenance, less fuel, $2.35/kw. for steam	107,000	214,000	169,200
Variable station operation and maintenance less fuel, $0.000148/kw.-h.		51,000	[4] 51,000
Total operation and maintenance less fuel, station, substation and lines	114,000	286,000	227,200
General and administrative expenses and payroll taxes, 13.3 percent	15,000	36,000	30,200
General and administrative expenses for hydro license	10,000		
Fuel expense ($5.50 per ton f. o. b. mines)		1,509,000	[4] 1,509,000
Total annual cost	2,829,000	3,233,000	2,890,400
Excess of annual cost of steam over hydro		404,000	61,400

[1] 72,000 kw. equipment with capability of 91,000 kw. for 2 hrs.
[2] Figures adjusted to be comparable to those relating to hydro project.
[3] Property tax pro-rated from steam program exhibit 15.
[4] Same kw.-h. and same coal figures as in exhibit 15.

Testimony of Mr. Holtzclaw

direct examination

[213] As I have previously stated, Virginia Electric and Power Company is prepared to go to work immediately and expend approximately $25,000,000 of its own capital in a three-year period to develop this power for distribution to its 450,000 customers in Virginia, North Carolina, and West Virginia, at rates which are regulated by the regulatory commissions of these three states in which it operates. All of its customers, including municipalities and cooperatives served by the company, will share the benefits of the development equally, without confining the advantages to the chosen few who happen to be customers of certain municipalities or of cooperatives.

Q. Mr. Holtzclaw, in the event your company's application for this license is not granted by this Commission, or if the license is granted with conditions attached which are unacceptable to your company, what arrangement will be necessary in order for your company to make provision for its needs of power supply for the near future?

A. If the company's application for this license is not granted or if the license is granted with conditions attached which are unacceptable to the company, it will be necessary [214] for the company to proceed with the expansion of its steam power plant program and to add generating capacity in substantial amounts to its existing steam power plants. Construction of the plant at Roanoke Rapids by the Federal Government would, in part, meet our needs, but we have no

assurance that plant would ever be constructed, and I do not believe we can afford to await its authorization.

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TESTIMONY OF MR. HOLTZCLAW

CROSS-EXAMINATION

[528] By Mr. WHITEHEAD:

Q. Your company produced as its first witness Mr. Eric W. Rodgers. Now, as a basis for the question I shall next ask you: I read to you a portion of the statement made by Mr. Rodgers on December 10, 1945, before a subcommittee of the Appropriations Committee of the United States Senate, and embraced in appendix 13 of the Definite Project Report on Buggs Island of 1946, which has been filed as Exhibit 10, that is, excerpts from which have been filed as Exhibit 10: "Now we come to the question of power. We may state without fear of contradiction that the power companies are fighting this matter vigorously. But the people of eastern North Carolina and Virginia want cheaper power and we believe their welfare outweighs any consideration for the power companies." Was your company one of the power companies which was fighting the proposal?

A. You mean by that the proposal to build the Buggs Island dam?

Q. Yes, sir; and the improvement of the Roanoke River Basin.

[529] A. I would say exactly what the Virginia Electric and Power Company did in that connection.

Maybe some of you are not familiar with it. When the amendment to the flood control bill was put into the United States Senate in 1944 there was no opportunity given anybody to be heard before the committee, because it was an amendment in the Senate. It never came before the House committee.

When I heard about it we employed the firm of Allan J. Seville and Company. We said, "Get an engineer, study this bill, study the report. Go down into Mecklenburg, Halifax, and Charlotte Counties, tell the people what is going to happen to them by the construction of Buggs Island and this tremendous lake and keep on telling them. Tell them you represent the Virginia Electric and Power Company. Tell them after being advised of what is going to happen if they still want it we will shut up."

When we concluded, after a year and a half of that campaign, that they still wanted it we withdrew any opposition.

Q. You mean by that that after your company had put on a campaign of a year and a half you found that it was fruitless and you abandoned it?

A. We found that the people wanted Buggs Island. They did not know what was going to happen to them when it was built.

Q. And isn't it a fact that Allan J. Seville and Company [530] employed by you published reports, included in the Richmond Times Dispatch, severely condemning this proposal?

A. I think that is true; yes.

CHIEF PRESIDING EXAMINER. He said he conducted a campaign of a year or more.

Mr. WHITEHEAD. Yes.

By Mr. WHITEHEAD:

Q. Now, when was it, Mr. Holtzclaw, that your company reversed its position and got on the side of the construction program?

A. When we became convinced that the people living in the valley really wanted the dam. That is the theory on which we sent Seville and Company into the basin.

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TESTIMONY OF MR. BARNES

DIRECT EXAMINATION

* * * * *

[1715] By Mr. MOORE:

Q. Mr. Barnes, have you any further comment with respect to the proposed use of the two percent rate used by Mr. Eardley in column G of Exhibit 48?

A. Long experience has shown that the risks of utility [1716] business are such that investors require a return of six percent to attract the capital required to conduct this business. If the government engages in this business it takes the same risks and, to the extent that it issues debt to 100 percent of the cost as compared with our 50 percent and charges the business only two percent interest, it is further subsidizing the operation by diluting its credit through failure to charge the fair market value of the risk assumed.

It is well known that the interest rates on government loans are presently artificial and have been controlled by manipulation of the money supply and federal reserve credit ever since the beginning of the last war. How long this can be continued it is impossible to predict, but if normal investment supply and demand return to control, it is doubtful if the present low rates can be maintained.

Short-term interest rates have already increased and the weighted average interest rate on the total interest bearing debt of the Federal Government at March 31, 1949, was 2.233 percent, as shown by the May issue of the Treasury Bulletin, page 17, as compared with 1.75 percent to 1.82 percent, as shown on sheet 3 of Exhibit 49.

This increase is due to increased rates on short-term borrowings and would be still greater except for the fact that some of the higher interest rate long-term debt has been replaced by short-term borrowing.

[1717] Interest rates alone do not reflect the full cost of money to the government. The Treasury Department incurs substantial expenses in directing the financing and in regulating the market for securities which it issues and for collecting taxes from which part of its funds are derived. It certainly is not a fair measure of the cost of money for a project which will not pay out for over 50 years, to take the present interest rates which are determined by rates paid for relatively short-term borrowings.

We now have a Federal Government debt of some 252 billions, as compared with 17 billions in 1929.

If it is good business for the government to use its credit to develop hydroprojects which private capital is ready, willing, and able to develop, because the government can secure money at two percent, as compared with a six percent return required for private financing, it is just as good business for it to take over all business. If that is to be the policy of the government, they should so declare and take over existing properties forthwith at a fair price and not subject them to a creeping paralysis as is being done in the Pacific Northwest.

Q. Mr. Barnes, referring now briefly to Exhibit 50, which was introduced through Mr. Eardley, have you any comments on that?

A. This exhibit is merely a summary of the data presented in Exhibit 48. The true savings resulting from government owner-[1718]ship and operation are fully analyzed and discussed in my earlier testimony, namely, that the apparent savings to consumers is very substantially offset by the loss of shifting of taxes. As I have already pointed out, if the downstream benefit payments are to be considered at all they should be included as part of the cost of operation of Roanoke Rapids by the government, for they would constitute revenue to the government which would be lost if VEPCO should not develop Roanoke Rapids and such loss would in effect result in a corresponding increase in the cost of Buggs Island power if the government operates Roanoke Rapids.

Therefore, the figures of Mr. Eardley in column (d) of Exhibit 50 should be increased and those in

column (e) decreased by the amount of downstream benefit payments in column (b).

For illustration, in Mr. Eardley's column (e), in Exhibit 50, last line, it purports to show that the "net savings to consumers" would be $2,711,000 annually, assuming a downstream benefit payment of $690,000 if Roanoke Rapids is constructed by the government rather than by the applicant.

There he neglects to give effect to the 38 per cent tax saving that would result if the company had to pay $690,000 downstream benefits, so that there is an error of $262,000 in his $2,711,000 figure, and that carries on correspondingly to the other figures in that column.

* * * * *

[1719] His purported "net saving to consumers" of $2,711,000 annually is very largely the result of, "robbing Peter to pay Paul," and an error in computation of $690,000, plus an error of $262,000.

* * * * *

[2009] Cross-examination by Mr. HANKIN:

Q. You mean, that if you construct a steam plant and you receive income from it, you would not pay income taxes?

A. What I mean is this, Mr. Hankin, that if the government builds Roanoke Rapids plant they will take from Virginia Electric and Power Company load requirements that would otherwise be supplied by Virginia Electric and Power Company, and if Virginia Electric and Power Company does not build the facilities to take care of those load requirements

and those supplied by the government, the government will lose federal income taxes of $747,000.

Q. Well, if that is the case, that the government supplies the power and takes that much off your load, you wouldn't need Roanoke Rapids, would you?

A. If the government builds Roanoke Rapids project, then they will take from the market the amount of load necessary to load that plant up.

Q. You mean, you have so much generating capacity now that all you need is Roanoke Rapids and no more?

A. No; I don't mean that. I mean that looking forward through the period of 50 years, which is the life of the Roanoke [2010] Rapids plant, Virginia Electric and Power Company would provide 90,000 kilowatts less of public load if the government builds the plant, than it would provide if Virginia Electric and Power Company builds the plant.

Q. Yes; but you do need capacity to serve your customers, do you not?

A. We need capacity presently to serve our customers.

Q. What I asked you was this: If you don't build Roanoke Rapids, then you will have to build a steam plant, won't you, to take care of your present requirements?

A. Yes; we will have to build a steam plant, but we would build less construction if the government builds Roanoke Rapids, than we would build if Virginia Electric and Power Company builds it.

Q. You mean, you would build a lesser plant than 91,000 kw., and that would suffice for your purposes?

A. That would suffice for the immediate purposes.

Q. But how about over a period of 50 years?

A. Over a period of 50 years we would install 91,000 kilowatts less capacity than we would have had we built Roanoke Rapids.

Q. But you would still need to put in that capacity, would you not? That 91,000 in steam?

A. Well, we would have to put in the capacity over that period of time represented by the load requirements of our system, [2011] which would be 91,000 kilowatts less than it would have been had we built the Roanoke Rapids plant.

Q. Now, then, you don't agree with Mr. Holtzclaw that if you do not get this license, or if conditions are imposed which are not acceptable to you, you would have to build a steam plant of approximately the same capacity?

A. No; I don't disagree with him in that statement at all, but I do state to you further——

* * * * *

The WITNESS. I do state to you and firmly, without fear of contradiction, that over a period of years, Virginia Electric and Power Company will build 91,000 kilowatts less of generating plants than it would build if it were permitted to build the Roanoke Rapids development.

By Mr. HANKIN:

Q. What about in the near future?

A. I would say within a period of a year there would be no change. In other words, our load is growing at the rate of approximately 45,000 kilowatts

a year. All that the loss of the Roanoke Rapids project does is necessitate our providing for the immediate growth. Over the period of years, however, that represents only two years' growth on the Virginia Electric and Power Company's system.

* * * * *

[2019] Q. I suppose you will agree, Mr. Barnes, that the production and sale of electric energy is a great public service?

A. Yes; I think it is.

Q. And that the consumption and use of electric energy contributes greatly to the enhancement of the standard of living of people?

A. I agree that it does.

Q. Do you know what has been the experience of the electric power industry concerning the effect of rate reductions on the [2020] consumption of electric energy? You probably heard Mr. Jessel testify on that subject yesterday.

A. Well, I have some knowledge of that on my own.

Q. I would like to hear it. What is it?

A. It is incremental in its effect on the use of electricity.

Q. You find that reductions in rates have stimulated the use of electricity beyond expectations?

A. I don't know that I would say beyond expectations, but it certainly gives people an incentive to use more electricity if rates are reduced, and the results have shown that that is true.

Q. Do you know what is the effect of increased use of electric appliances on those manufacturing those appliances?

A. I suppose you mean it has created industry.

Q. Yes. Has it increased their income?

A. If they have operated profitably, it has increased their income.

Q. Would you say that has served to increase the amounts that they pay for income taxes?

A. Yes; I think that is true, if their operations are profitable.

* * * * *

[2021] By Mr. HANKIN:

Q. Do you know whether increased use of electric energy by merchants, for example, in erecting electric displays, electric signs, et cetera, operates to increase their income?

A. Yes; I presume it does, or they wouldn't buy the electricity.

Q. What would be the effect on the income taxes they would have to pay to the Federal Government?

A. I think that might decrease the income taxes to some extent, although if their business was profitable it probably would result in a net increase.

Q. You mean there would be a decrease because of the expenses, but there would be a net increase because of the additional income?

A. If their business was profitable there would be an increase.

Q. You don't question that it is profitable, do you?

A. I think there are limits within which it is profitable [2022] and limits beyond which it is unprofitable.

Q. And the business world does not go into so much electric advertising simply on the chance that it might increase their incomes?

A. Certainly people who indulge in advertising think it is going to make their business profitable.

Q. Can you give us any idea of what is the effect of electrification on farms?

A. It has served to reduce the amount of manual labor that is required otherwise.

Q. What effect has it had on the income of farmers?

A. I think probably it has helped the farmers' income.

Q. Very considerably, has it not?

A. Well, to some extent. The farmer still can use more income. Being a farmer, I speak freely.

* * * * *

[2029] By Mr. HANKIN:

Q. I take it you do not agree with the statement of the President quoted on Exhibit 49 in this proceeding?

A. I take it that this reference is to page 2 of the exhibit where they quote from the President in his 1948 Budget Message, which apparently was issued before February 20, 1947, which is over two years ago and I would like to read the first two sentences:

> From now on most corporation programs will be revenue producing. Accordingly, I recommend that corporations be required to reimburse the Treasury for the full cost to it of money advanced to the corporations.

Q. Would you read the rest of the quotation?

A. I would be very glad to.

> Interest paid on borrowings from the Treasury should be based on the current average rate on outstanding marketable obligations of the United States, now about 1.8 per cent. Dividends should be paid on capital stock if earned. While these changes in the amount of intragovernmental transactions will not affect the budget deficit or surplus, they will cause the corporation's records to reflect more nearly the true costs of their operations.

I don't understand that the Department of the Interior is a corporation so I do not know that it applies to money advanced on account of projects that are to be operated by the [2030] Department of Interior. He says that they should pay the full cost of the money advanced and I think they should pay that, certainly. I don't think that the full cost of money is represented by the current interest rate. The project is being financed for a period of 50 odd years as a minimum, and the present interest rates do not determine what the total cost of money would be to the government during that period on funds tied up in the development.

Q. You state that you do not know the Department of Interior is a corporation. Would you read the paragraph preceding that quotation?

A. The paragraph in the body of the letter from the Assistant Fiscal Secretary?

Q. Right.

A. "It seems to me that the problem of the appropriate rate of government funds invested in the

Bonneville project is substantially the same as that of the rate on such funds advanced by the Treasury to government corporations."

That is the statement of the assistant secretary and not the President.

Q. Now, as applied to the Department of the Interior my question was whether you agreed or disagreed with the statement quoted from the President's message?

A. I think I have answered that by saying that I agree [2031] with the President that the budget should be charged with the cost of money to the government. I also said that I did not think the cost of money could properly be measured by current interest rates, as the money is going to be tied up for the period of the development.

Q. You disagree with the President as to the facts regarding the cost of money to the United States; is that right?

A. I think that is the minimum that should be charged.

* * * * *

[2033] By Mr. HANKIN:

Q. You say that "If it is good business for the government to use its credit to develop hydroprojects which private capital is ready, willing, and able to develop—" and I omit some language—"it is just as good business for it to take over all business." My question to you is, do you make no distinction between construction of hydroplants and private business.

A. No; I make no distinction.

Q. You think they are on the same basis?

A. I think they are on the same basis. In other words, I believe in private enterprise.

Q. Are you in the public utility business?

A. I am half in the public utility business and half in the farming business.

Q. I mean, is your corporation, VEPCO, in the public utility business?

A. Virginia Electric and Power Company is a public utility.

* * * * *

[2036] Q. I would like to ask you this question: Assuming that [2037] the feasibility of a project is measured in terms of the benefits to consumers, rather than the benefit to the company, which project is of greater benefit to the consumers, the one constructed by VEPCO or the one by the United States?

A. I would like to have you define, or I would like to have defined before answering that question, how comprehensive you consider the words "benefit to consumers."

Q. Well, I will be glad to explain that. I take it that the consumers being ordinary persons would like to buy as cheaply as they can, and if they find they can buy something for 10 dollars rather than for 15 dollars they consider it that much of a benefit to them. Now, when you construct your hydroproject you are saying that as compared with a steam project the consumers will save $404,000—that is without considering the downstream benefits. On the same basis

you say that the consumers will save $2,021,000 considering the maximum downstream benefits stated in the transcript. Which project do you think * * * would be of greater benefit to the consumers?

* * * * *

[2039] The WITNESS. Let me ask this, if I may take the lawyer's end of this discussion: You mean the consumers of electricity that would be consumed from the Roanoke Rapids project?

By Mr. HANKIN:

Q. Right.

A. And merely the benefits from the standpoint of what they would pay for electricity?

Q. Right.

A. First, let me say that I don't think they would save $2,021,000, but I do think they would pay lower rates if the Interior Department operates the project, if the Government builds it, then they would pay if Virginia Electric and Power Company builds and operates the project. That does not give effect to the offsetting items which we have discussed heretofore, namely, the taxes which would have to be lost or shifted, nor does it take into effect the adjustment that Mr. Eardley should have made in column E of his Exhibit 50, to reflect not only the $690,000 benefit payments, but also the $262,000 reduction in cost to the Virginia Electric and Power Company, as shown in Column C, as a result of application of the 38 percent tax rate on $690,000 assumed charge for downstream benefits.

[2040] By Mr. HANKIN:

Q. Yes, Mr. Barnes, that is a way of explaining that fact, but the fact remains, doesn't it?

A. The fact remains——

Q. That is right.

A. (Continuing) That the government cost of operating the project, charging against it what will be charged, will result in lower rates for the sale of energy to consumers from that project, than would result if Virginia Electric and Power Company builds and operates the project.

Q. Now, just one more question and I think we will be done. On page 1719 of the transcript you made a reference to "robbing Peter to pay Paul." I would like to know who in this instance is the robber, who is Peter and who is Paul.

A. I think I could define that without any difficulty at all. The government is the robber; Peter are the taxpayers of the country, and Paul are the individual consumers who will receive electricity from the government's operation of the Roanoke Rapids project.

* * * * *

[2041] Q. If the government is the robber who does it rob of what?

* * * * *

The WITNESS. The government imposes taxes on consumers that are not benefitted by the government operation of the hydroproject, to subsidize the sale of electricity to the consumers who are customers of the government operation of Roanoke Rapids.

By Mr. HANKIN:

Q. You mean there are those who are not benefitted by the hydroprojects throughout the country; is that what you mean?

A. Do I mean that there are those?

Q. Yes.

A. Certainly. Everybody throughout the country who pays taxes, pays income taxes throughout the country is going to have their income tax affected if the government builds the Roanoke Rapids project.

Q. And they are not benefitted by it; is that correct?

[2042] A. No, they are not.

Q. That is your conception of the way our government operates?

A. That is my conception of what would happen if the government develops the Roanoke Rapids project in lieu of Virginia Electric and Power Company.

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[5846] EXCEPTION No. 12

Exception is taken to the Examiner's treatment of the "dependable capacity" of the proposed project without reference to the period of time during which such capacity would be dependable, i. e., "the time interval and the period specified when related to the characteristics of the load."

It is proposed that the Commission adopt the following definitions which appear in the "Glossary of Important Power and Rate Terms, Abbreviations, and Units of Measurement," prepared under the supervision of the Federal Power Commission (hereinafter referred to as the "Glossary"):

Capability—the maximum load which a machine, apparatus, station, or system can carry under specified conditions for a given time interval.

Capacity—the load for which a machine, apparatus, station, or system is rated.

Dependable capacity—the load carrying ability for the time interval and period specified when related to the characteristics of the load to be supplied. Dependable capacity of a station is determined by such factors as capability, operating power factor and portion of the load which the station is to supply.

Reasons for the Exception

Unless these definitions are kept clearly in mind, one cannot arrive at a determination of the facts, and the result obtained is a confusion of terms with little or no meaning.

It will be noted that the term "capacity" is defined as "the load for which a machine, apparatus, station, or system is rated." [5847] There is no dispute in this case concerning the "capacity" of the Applicant's proposed project. It is to be assumed that it will have an installed capacity of 91,000 kw.

"Capability" is defined in the Glossary as "the maximum load which a machine, apparatus, station, or system can carry under specified conditions for a given time interval." As applied to this project, this does not necessarily mean 91,000 kw. under all conditions and for all intervals of time. While under some conditions the project could carry such a load for a given time interval, there are other conditions under

which that would not be possible. The project may have a "capability" of 91,000 kw. for one interval of time, but not for another and longer interval of time.

"Dependable capacity" is defined in the Glossary as "the load-carrying ability for the time interval and period specified when related to the characteristics of the load to be supplied." It will be noted from this definition that "dependable capacity" differs from "capability" in that, while "capability" is defined without reference to the load to be supplied, "dependable capacity" is the "capability" related to the characteristics of the load to be supplied. The definition of "dependable capacity" also specifies some of the factors which enter into the determination of the amount of "dependable capacity"; namely, the capability, the operating power factor, and the portion of the load which the station is to supply. In the course of the hearing, some of the witnesses for the Applicant and the Staff used the phrase "dependable capacity of the project dependable upon the load of the VEPCO system." Related to the definition in the [5848] Glossary, this simply means that the project will have a given dependable capacity whenever required to handle a portion of the annual maximum peak load of the VEPCO system.

In the case of a steam plant, the "capacity," as above defined, is substantially the same as its "capability," because such capacity is available under all conditions and for all periods of time (T. 3483). In the case of a hydroproject, the capacity and capability are not the same, because the capability of the

project is dependent not only upon the units of the project itself, as in the case of the steam plant, but also upon the availability of water in the required volume. If a project has a capability of 91,000 kw. during the most critical low-flow periods, it will have that capability during the average and high-flow periods (except during high-flood periods, when the project may have to operate under reduced head). If, however, the project has such capability during average or high-flow periods, it will not necessarily have that capability during critical low-flow periods, as has been testified by Mr. Hamilton (T. 2857). This is the reason why the capability of a hydroproject is determined by the availability of water during the most critical low-flow periods.

Since the dependable capacity is the capability when related to the characteristics of the load to be supplied, the dependable capacity also depends upon the availability of the water during the most critical low-flow periods. Stated in another way, the dependable capacity of a hydroproject is that amount of kilowatts available to carry a portion of the system load at the time and for the period when the requirements of the system are greatest and the amount of water [5849] available for generation is least.

The requirements of the VEPCO system, according to the testimony of the Applicant, are greatest in the month of December. For the foregoing reasons, it is sufficient to consider the requirements for the one month of December in order to determine the dependable capacity of Project 2009, without going into the requirements for the other months of

the year. It must be noted, however, that the Applicant's testimony related to the present time and to what may be expected within the succeeding few years. There is no evidence in the transcript as to what will be the requirements of the VEPCO system after 1955, or for the remaining 45 years of the normal license period.

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[5321] (1) *The Federal Power Policy*

The Federal Power Policy has two aspects, one relating to the utilization of power, the other to rates. The first is a policy against monopolization and in favor of the most widespread use of power; the second is a policy that such service should be rendered at cost and that consumers should pay the lowest possible rates consistent with sound business principles. The Federal Power Policy is not new. It is a culmination of legislation which has extended over four decades. Nor is this a policy which is incident only to public ownership. It is a policy patterned after the functions and duties generally attributable to public utilities.

The policy to encourage the most widespread use of power is analogous to the duty of a public utility to serve the public generally and without discrimination. The policy to dispose of energy in such a manner that the consumers will pay the lowest possible rates consistent with sound business principles is analogous to the duty of a public utility to render service at "reasonable rates," sometimes denominated as "the

value of service," sometimes as "cost" (including the cost of capital).[22]

However, we are concerned here only with developments undertaken by the Government itself. For a better appreciation of [5322] the Federal Power Policy as applied to such developments, it is well to note a few of the legislative landmarks in the development of the two aspects of the policy.

(a) ENCOURAGEMENT OF MOST WIDESPREAD USE

In the Act of April 16, 1906,[23] Congress, recognizing that the waters conserved for irrigation could also be utilized for production of power, authorized the Secretary of the Interior to lease any surplus power or power privilege, giving preference to municipal purposes, thus evidencing an intention that the power benefit should be widespread, rather than concentrated in one or a few persons or corporations.

In the Raker Act of 1913,[24] the City of San Francisco was granted the use of National Park lands for the purpose of storing water for domestic use and for the purpose of developing power. At the same time, the City was prohibited "from ever selling or letting to any corporation or individual, except a municipality or municipal water district or irregation district, the right to sell or sublet the water or the

[22] See concurring opinion of Justice Brandeis in Mo. ex rel. *Southwestern Bell Tel. Co.* v. *Public Service Commission*, 262 U. S. 276, 291. The minority opinion in that case is the law of the land today. See *Federal Power Commission* v. *Hope Natural Gas Co.*, 320 U.S. 591, 603.

[23] 34 Stat. 117.

[24] 38 Stat. 242.

electric energy." [25] Here, again, Congress expressed the policy that this power shall not be monopolized or limited in use, but that it should be widespread.

In 1933 Congress embarked upon a great experiment. It passed the Tennessee Valley Authority Act,[26] in which it provided for the [5323] full utilization of the water resources of the region, including the production of power. It provided that, in the dispositon of power, the benefits of this governmental undertaking should inure directly to the people of the region. These benefits were to be as widespread as possible, by giving preference to States, counties, municipalities, and cooperative organizations "not organized or doing business for profit, but primarily for the purpose of supplying electricity to its own citizens or members." In this act, and in its later amendments, this policy against monopolization of power is emphasized by provisions for the encouragement of the use of electric energy for domestic and rural consumption and by provisions imposing limitations on the sale of power for resale.

In 1936 the Rural Electrification Act [27] was passed to enable farmers to organize into nonprofit organizations for the purpose of constructing or acquiring facilities for the transmission and distribution of electric power and energy to their members. This act, together with the acts which made power available, was also in furtherance of the policy against

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[25] *United States* v. *San Francisco*, 310 U. S. 16.

[26] 48 Stat. 58.

[27] 49 Stat. 1363.

monopolization, and for the widespread use of electric power.

In 1937 Congress passed the Bonneville Project Act,[28] in which the policy against monopolization of power was reiterated and in which it was provided that preference in the sale of power be given to "public bodies and cooperatives." The same policy was implemented in the Fort Peck Act of 1938,[29] in which, after declaring that the "facilities for [5324] the generation of electric energy at the Fort Peck project shall be operated for the benefit of the general public, and particularly of domestic and rural consumers," the Bureau of Reclamation was required, in disposing of the electric energy, to give preference to public bodies and cooperatives.

(b) SERVICE AT LOWEST POSSIBLE RATES

At the same time, Congress consistently recognized the necessity of making power available to consumers at the lowest possible rates, or at cost. The preference in the sale of power given to States and municipalities in the Reclamation Acts meant, of course, that the consumers would probably receive such power at cost or that the people would receive the full and undiminished benefit of the power furnished. In the Tennessee Valley Authority Act, Congress expressly provided that the T. V. A., in selling power to or for the use of industry, should secure a sufficiently high load factor and revenue return to "permit domestic and rural use at the lowest possible rates." In this

[28] 50 Stat. 731.
[29] 52 Stat. 405.

act (secs. 9 (a) and 10) Congress also sowed the seed which germinated into the rate provisions of the later enactments.

Beginning with the Bonneville Project Act of 1937, Congress provided that the rate schedules applicable to power from Government projects should be drawn with regard to the recovery of the cost of producing and transmitting the electric energy, including the amortization of the capital investment over a reasonable number of years; and by the capital investment, Congress meant the investment fairly allocable to power. The same provision was included in the Fort Peck Act of 1938. In the Reclamation Project Act of 1939,[30] Congress [5325] prescribed that the rates charged for the sale of power should produce revenues sufficient to cover the portion of operation and maintenance costs allocable to power and interest at not less than 3 percent on the investment allocable to power. The interest component in the rates was apparently calculated to be the equivalent of amortization and cost of capital.

(2) *Extension of the Federal Power Policy to Flood Control Projects*

While these policies were being developed with respect to the disposition of power from Government projects, great developments were taking place with respect to flood control. In 1917 Congress passed an act[31] authorizing the Army Engineers to conduct

[30] 53 Stat. 1187.
[31] 39 Stat. 950.

examinations and surveys for flood control. Congress required that the reports of the Rivers and Harbors Engineers include data in regard to—

> (a) the extent and character of the area to be affected by the proposed improvement; (b) the probable effect upon any navigable water or waterway; (c) *the possible economical development and utilization of water power;* and (d) such other uses as may be properly related to or coordinated with the project. [Emphasis supplied.]

From time to time thereafter Congress authorized and directed that surveys be made of river basins and, upon reports submitted by the Army Engineers, authorized the construction of numerous flood control projects, some with and others without power facilities.

Prior to 1936, the Flood Control Acts concerned themselves with specific improvements to control the destructive flood waters as a means of preserving the navigability of streams. The control of **[5326]** floods through the construction of dams and reservoirs and the utilization of the stored water for power development, however, became a recognized need.

In the Flood Control Act of 1936,[32] Congress embarked upon a systematic utilization of these flood control projects for the development of power. In section 5 of that act, it adopted and authorized the construction of a large number of projects "for the benefit of navigation and the control of destructive flood waters and other purposes" and provided "that

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[32] 49 Stat. 1570.

penstocks or other similar facilities, adapted to possible future use in the development of adequate electric power *may* be installed in any dam herein authorized when approved by the Secretary of War upon the recommendation of the Chief of Engineers" [Emphasis supplied.] This was followed by the act of August 28, 1937,[33] in which Congress again authorized a large number of such improvements. In the Flood Control Act of 1938,[34] Congress again authorized the construction of a large number of projects for flood control, and there provided that penstocks and other facilities adapted to future use in the development of electric power "shall" be installed in any dam therein authorized, when approved by the Secretary of War upon recommendation of the Chief of Engineers and the Federal Power Commission. The same provision was included in the Flood Control Act of 1941.[35]

[5327] By the end of 1944 Congress had specifically authorized numerous projects for flood control and power development, and had generally authorized others by approving comprehensive plans of river basin developments. It was necessary to set up administrative machinery for the disposition of the power to be generated at these projects. This was done in section 5 of the Flood Control Act of 1944 by vesting in the Secretary of the Interior the function of marketing the surplus power and energy generated at all reservoir projects under the control of

[33] 50 Stat. 876.
[34] 52 Stat. 1215.
[35] 55 Stat. 638.

the Department of the Army. At the same time, Congress reasserted and implemented the policies previously developed, by requiring the Secretary to market this power in accordance with the following standards:

(a) He must dispose of the power so as to encourage the most widespread use thereof.

(b) Preference in the disposition of such power must be given to public bodies and cooperatives.

(c) The power must be disposed of in such a manner that the consumers will benefit therefrom at the lowest possible rates consistent with sound business principles.

(d) The rates at which the power is sold must be so calculated that, on the basis of their application to the power capacity, they will, over a reasonable number of years, recover the cost of producing and transmitting the power, including the amortization of the investment fairly allocable to power; and

(e) The rates must meet the approval of the Federal Power Commission.

[5328] These requirements are interrelated, and their application necessarily involves the exercise of judgment and discretion, as also the balancing of conveniences, interests, and rightful expectations. For example: The preference to public bodies and cooperatives serves as a means for disposing of the power so as to encourage the most widespread use. As between preference customers, and with respect to power not taken by such customers, the Secretary must weigh and consider what disposition would result in a more widespread use. The requirement that

the power and energy be so disposed of that the consumers will pay the lowest possible rates, compatible with the maintenance of adequate service, is not unrelated to the requirements to encourage the most widespread use and to give preference to public bodies and cooperatives, as has already been indicated in connection with our discussion of the Federal Power Policy. And it requires no argument to demonstrate the interrelation between the requirement as to lowest possible rates to consumers and the requirement that the Secretary dispose of the power at rates calculated to recover the cost of producing and transmitting the power and energy, including amortization. The two standards, in effect, operate to prescribe a zone of reasonableness for the rates chargeable by the Government and those payable by the consumers.

In order that the Secretary may apply these standards most effectively, the power and energy from all the projects in a river basin where development is undertaken by the Government must be available to him, insofar as that is feasible. In connection with the decisions that he must reach, much depends on the extent and [5329] character of the market and on the quantity, type, and cost of the power available. Since the projects upstream contribute to the value of the downstream developments, it is necessary to coordinate and integrate all these projects, in order to derive the maximum benefit, and thus reduce the unit cost.

Therefore, where the development of a river basin has been undertaken by the United States but Congress has not yet reserved a project for the United

States, and the Commission has not yet arrived at the conclusion that such project should be undertaken by the United States, it is submitted that the Federal Power Policy and the functions and duties of the Secretary are controlling considerations on the question whether the Commission should conclude that the development should be undertaken by the United States. Otherwise, the Commission might give away power benefits of great proportions to which the United States is entitled. This appears clearly in connection with the facts in this case.

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